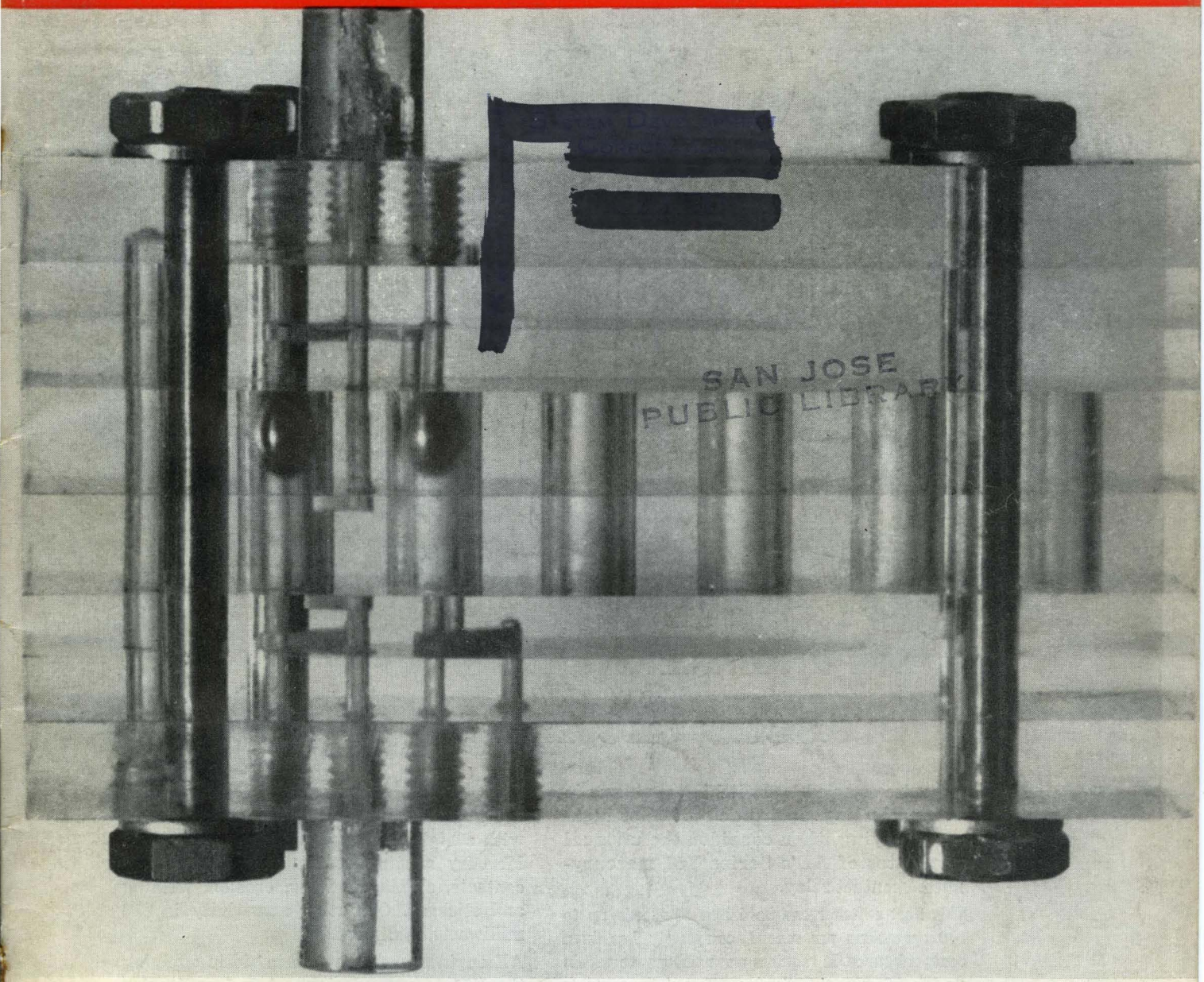
COMPUTERS and AUTOMATION

COMPUTERS AND DATA PROCESSORS, AND THEIR CONSTRUCTION, APPLICATIONS, AND IMPLICATIONS, INCLUDING AUTOMATION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JULY
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VOL. 10 - NO. 7

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COMPUTERS *and* AUTOMATION

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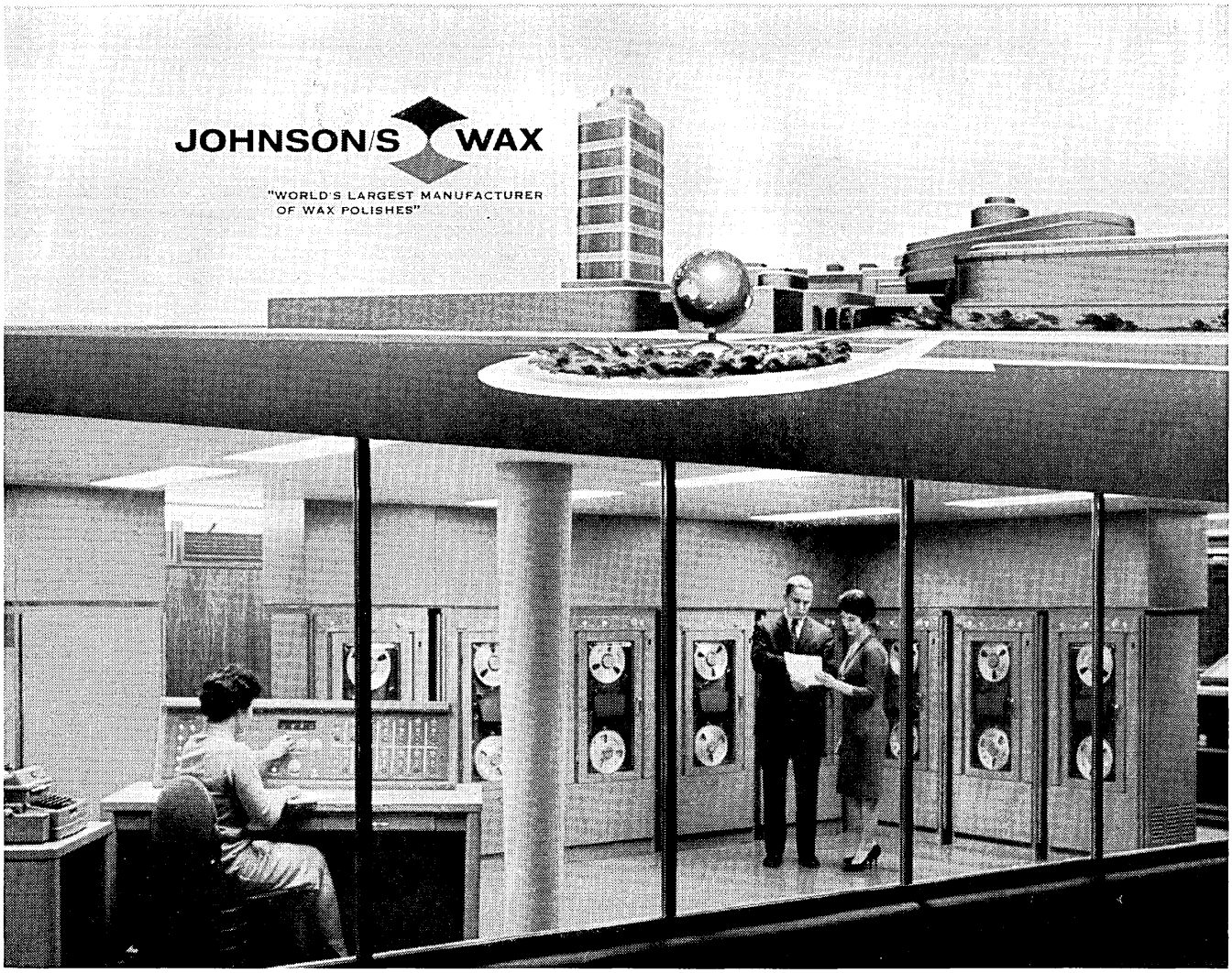

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Readers' and Editor's Forum

FRONT COVER: MEMORY FOR A PNEUMATIC DIGITAL COMPUTER

The front cover shows a laboratory prototype of a component for a pneumatic digital computer, under design by Kearfott Division, General Precision, Inc., Little Falls, N. J. This component contains 2 bistable elements or flip-flops and has the capacity for 4 more. The "piping" consists of holes drilled in the layers. Connections to the flip-flops are made through the screwholes at the top and bottom. The component is created by clamping the layers together.

Each chamber containing a little ball has two inlets and two outlets for gas either under high pressure or low pressure. Pulses of pressure operate the pneumatic components.

The entire size of the prototype component shown is a little over an inch long and a little over half an inch thick. Much smaller sizes are possible. An eventual component density is indicated of 2,000 to 4,000 bistable elements per cubic inch. Under these conditions, a medium-size general-purpose digital computer will occupy a slab approximately 5½ inches square and one inch thick. Operating speed indicated is in the range of 10 to 100 kilocycles. Operating temperature can be well over 1000° F.

All digital operations can be considered to be combinations of three basic functions: counting, switching (also called logic), and memory; and these three basic functions can all be represented with pneumatic components. In addition, signal conversion is possible from pneumatic to electronic (for example, by sensing electrically the position of the little metal balls) and from electronic to pneumatic (for example, by electromagnetic impulsing of the little balls).

COMPUTERS IN NUCLEAR ENGINEERING

Dr. Jan Paul
Nuclear Consultant
2617 Lynn Street, Bakersfield, Calif.

There are a number of individual applications for computers in nuclear engineering. Some of the more important are data logging, alarm scanning, on-line computation, sequencing, data reduction, automatic control, and reactor monitoring. All are important, but perhaps the most important single application is in reactor monitoring, for in such an application it is possible for the computer to monitor radioactivity in the reactor through a hook-up with the cooling and heat-transfer systems.

Perhaps one of the most interesting computer applications is at the Electricite de France power plant near Chinon, France. The installation is of particular interest in a discussion of applications, because its computer system, while primarily for monitoring, actually combines a number of important uses. The system consists of two RW-300 computers, seven automatic typewriters, a paper tape punch and reader, radiation detectors, binary counters, sequencing and timing equipment, and input-output equipment for the computers.

The basic principle behind the system is quite simple; any kind of break or fault will cause an increase in the level of radioactivity in the reactor cooling system. It is essential that this increase be detected before it can become harmful to personnel or equipment. The radiation detectors in the system are placed in the cooling channels and connected to the binary counters, which in turn, are scanned continuously by the computers. The computers use the data obtained to calculate a radioactivity level for each channel and compare it against a predetermined limit. If the calculated level thus obtained exceeds the limit, alarm and warning devices are automatically activated.

The computers are operated in parallel to assure uninterrupted protection. Both machines therefore receive all input data, and make all calculations; however, only one operates the automatic typewriters and alarm devices. They are systemed, however, so that should either computer stop, break down, or make an error, the remaining machine takes over all output devices. Each computer checks itself once a minute.

Of the seven typewriters in the system, five print computed radioactivity values. One does nothing but indicate equipment failure, while the remaining machine logs reference values.

This particular reactor installation has 1,148 cooling system channels, which, for the purpose of scanning, are divided into 287 groups of four. Twelve channels are scanned per minute, so that a total scanning cycle takes 24 minutes. In the event of an above-normal reading, all four channels in the group are switched to a "fine" scanning system through which the computers can calculate a normalized level for each separate channel. If any of these exceed normal, warning devices go into action.

A careful evaluation of this, and similar computer monitoring systems indicates that these systems make possible the continuous calculating of radioactivity levels over an extensive channeling system with a maximum reliability factor and a minimum of alarm error. The safety factor for both personnel and equipment is also greatly increased.

COMPUTERS AND ARMAMENTS

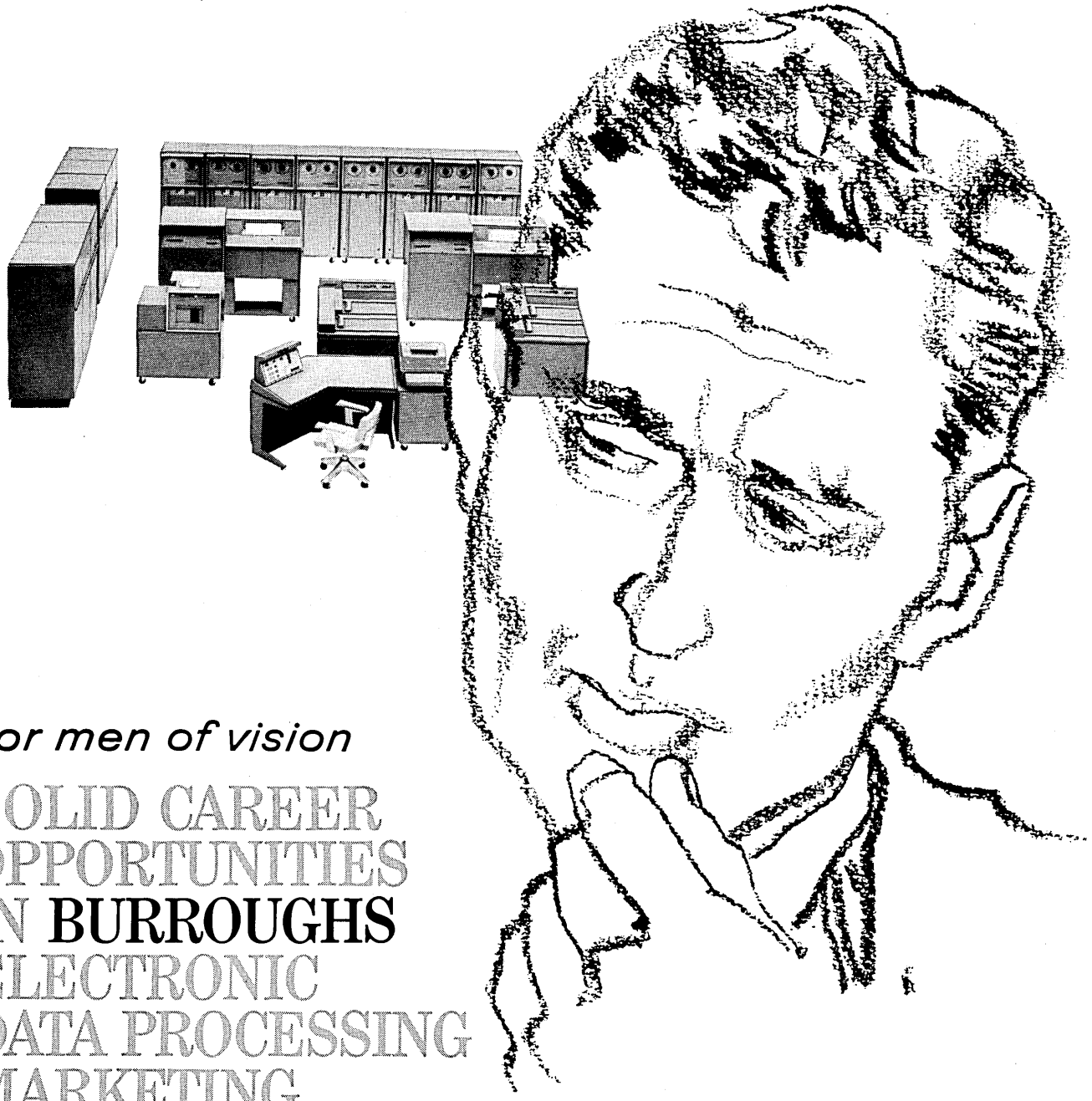
I. From Carl H. Groom

Arlington, N. J.

To the Editor:

With reference to your article "Armaments and Computer People" in the May issue, I believe you leave out of account a rather important fact. This is that every arms race recorded in history has resulted in a war. There are formidable odds, therefore, that the present arms race will result in war. Therefore, the major task of patriotic computer people, other scientists, and in fact everybody in the United States,

(Please Turn to Page 22)



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"Open Shop" Programming at Rocketdyne Speeds Research and Production

D. J. Breheim
General Supervisor, Programming
Rocketdyne, a division of North American Aviation, Inc.
Canoga Park, Calif.

Engineers Writing Programs for Themselves

Computer usage is high, engineering problems are solved quickly and completely, and design and production benefit accordingly, with "open shop" programming of scientific problems at this division.

Some 400 of our engineers, at least one in every engineering group, write computer programs for themselves and their fellow engineers by using a formula translator which enables them to address the computer in more or less familiar language. A "monitor" system we have coupled to the computer allows us to run a tremendous volume and variety of their problems quickly and efficiently. Thus, we have placed in the hands of our creative engineers a "super slide rule."

Fully as important, our engineers are in direct contact with our computers, an IBM 709 and a 7090. Thus they are familiar with what these machines can do and tend to program onto them the "total" problem, not just a piece of it at a time.

Expediting Solutions

This, too, expedites the solutions to design problems and, eventually, speeds production itself.

In rocketry, of course, problems that stand in line awaiting solution quickly become so dated they aren't worth solving. We are convinced that "closed shop" programming, in which our engineers would bring their problems to full-time programmers, would tend to create bottlenecks.

For one thing, an engineer can write his own program in one-fourth as long as it would take him to give it to a programmer and get it checked out. Even more important is the problem of communication. For example, a programmer might think he understood a problem when actually he did not. Reprogramming then would become necessary.

This is understandable, because no one person can master the fields of stress, heat flow, aeronautics, etc., and the other incredibly diverse uses for which our computers must be programmed. Even when a programmer understands the field generally, he often lacks the "feel" for a specific problem which the engineer himself has.

In addition, making the computer available to the engineer, either through his own ability to program, or that of a fellow worker, encourages him to use it—encourages the "let's try it" attitude so valuable in creative engineering.

Shortening of Training Time

Also, through the use of FORTRAN, IBM's standard formula translator which implements our open shop, the training time for a programmer has been cut from 60 hours to just 20 hours. And, our engineers can and do write usable programs as soon as they've completed their 20-hour course. Without FORTRAN, a graduate of the 60-hour course used to spend six to eight months learning to write sophisticated programs.

Thus, the goal of our open shop is not to produce a relatively few, highly sophisticated programs. It is to encourage engineers to solve the largest number of problems via workable computer programs, with the end result of getting the best product built, most economically, in the shortest possible time.

While this has always been a desirable goal throughout industry generally, it is particularly pertinent to the missile industry. Any discussion of the missile race is superfluous, of course. Even the most casual scanner of headlines knows we are in it, and may believe that the very survival of the United States may hinge upon the outcome.

Rocketdyne's Background

Rocketdyne's contribution toward high-thrust rocket engines and advanced forms of propulsion for use in space date back to 1946.

Missiles and research vehicles powered by our engines include the Army *Redstone,* medium-range missile; the Air Force *Thor* and Army *Jupiter,* first intermediate-range ballistic missiles; the Air Force *Atlas,* our nation's first intercontinental ballistic missile, and many of our nation's space probes, including the *Redstone*-boosted Explorer satellites in 1958; advanced space probes by the Air Force and Army, the Discoverer series of polar satellites, etc.

Our main offices, plant and data processing center are located at Canoga Park, near Los Angeles, California. We also have plants at Neosho, Missouri, and McGregor, Texas; and a Propulsion Field Laboratory for research, development and production testing in the Santa Susana Mountains, near Canoga Park.

Our two IBM 709's are in operation 24 hours a day, seven days a week. About 90 per cent of their usage is scientific. Of this, about three-fourths is for Rocketdyne and about one-fourth for Atomics International, another division of North American Aviation.

In addition, our data communications system enables us to handle overflow work from North American, in Los Angeles.

Nature of Computing Load

Our computing includes quite a bit of test data reduction, performance analysis programs, trajectory

programs, reliability studies, etc. We process more than 200 jobs a day on the 709's.

As indicated, a large percentage of these are from the 400 engineer-programmers we have encouraged to use the machines. It is necessary, of course, to handle these jobs quickly and efficiently, or we lose the value of open shop.

As set up, if an engineer gets a routine problem to us by late afternoon, the results are on his desk early the following morning. If he gets it to us in the morning, he has his results by afternoon. And, on a priority order, we give him fast enough service so he can have two or three shots at the 709's on the same day.

Our goal is a "turnaround" time of three hours on routine work, exclusive of keypunching, and two hours for a priority job. Rush work, such as acceptance tests, is handled much more rapidly, of course. Ten minute service is about average.

The Monitor System

The monitor system, mentioned earlier, and careful channeling of incoming work, enable us to process our high volume quickly and efficiently.

We call the monitor our "Load and Go" system. Developed here in 1958, it was subsequently used by IBM as the basis for the SHARE-STANDARD system, now widely used with FORTRAN. The monitor enables us to group jobs efficiently on the same tape, with the machine doing most of the controlling.

When an engineer has completed a program, he sends his data sheet to data processing in a special gray envelope, used only by DP. The data sheet may be accompanied by a program deck, or we may already have the deck on file.

A receiving clerk checks the sheet for legibility, then routes it to an IBM Card Punch Operator, who produces a data deck from it. Next stop is the set-up section, where the deck is checked and placed in back of the proper program deck.

The program and set-up decks are sent to a dispatcher who assigns several jobs to each tape, in most cases, and sends them into the 709 room. There, the cards are loaded onto one of two card-to-tape conversion units, and the information from them is reproduced on magnetic tape.

The tape then goes to whichever of the 709's is open. The operator loads it onto a tape unit, starts the program and just monitors the time on each job.

If there were any errors in programming, the 709 prints out a notice and the specific program is shunted off the machine.

When all the jobs on the input tape have been run, the operator removes the computed data, on just one output tape, and places it on an off-line Tape-to-720 II-Printer to produce a hard copy of the results at 500 lines a minute.

When the program calls for it, the 709 also produces a second output tape, from which a deck of output cards is punched.

The computed data sheets, and any output cards, go into a gray envelope, and back to the originator by special courier.

Elimination of Duplication

One of the traditional problems of the open shop is duplication of effort. To eliminate this as much as possible, we have published all programs devised here, and distributed them through North American Aviation.

We do not envision the day when every engineer will write programs, or when full-time programmers will be eliminated, of course. We still have the equivalent of 50 of them busily at work on a variety of jobs, including teaching FORTRAN, debugging programs, handling complex programming, and programming commercial work via COMFORT, our version of commercial FORTRAN.

But, we do believe that the open shop educates our engineers in the maximum use of the computing tools available to them, and encourages them to use these tools properly, not on a hit-or-miss basis.

The result is that more programs are written, more problems are solved, and more products are built, faster, better and more economically. This, of course, is the major goal of all of Rocketdyne.

WHO'S WHO IN THE COMPUTER FIELD

From time to time we bring up to date our "Who's Who in the Computer Field." We are currently asking all computer people to fill in the following Who's Who Entry Form, and send it to us for their free listing in the Who's Who that we publish from time to time in **Computers and Automation.** We are often asked questions about computer people—and if we have up to date information in our file, we can answer those questions.

If you are interested in the computer field, please fill in and send us the following Who's Who Entry Form (to avoid tearing the magazine, the form may be copied on any piece of paper).

Name? (please print) .....

Your Address? .....

Your Organization? .....

Its Address? .....

Your Title? .....

Your Main Computer Interests?

( ) Applications
( ) Business
( ) Construction
( ) Design
( ) Electronics
( ) Logic
( ) Mathematics
( ) Programming
( ) Sales
( ) Other (specify):

.....

Year of birth? .....

College or last school? .....

Year entered the computer field? ....

Occupation? .....

Anything else? (publications, distinctions, etc. .....

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When you have filled in this entry form please send it to: Who's Who Editor, **Computers and Automation,** 815 Washington Street, Newtonville 60, Mass.

AUTOMATED TEACHING

E. F. Cooley
Director of Methods Research
The Prudential Ins. Co. of America
Newark 1, N. J.

(Based on a talk given at a Personnel Management Conference, in Mobile, Ala., February, 1961)

Automated teaching is an important subject. It is important because the new methods currently being developed offer real hope of reducing waste, and waste reduction is always important. The waste in this case is the waste of time of students and trainees, and this waste means waste of the money of schools and of employers.

The purpose of this report is to give a general survey in elementary terms.

Hazards in Ordinary Class Training

Training is ususally done in classes of 15 to 25 people. Whenever you have a group that big in any activity, there is bound to be compromise of some kind. The place, the time, the instructor, all are compromises to some extent. A class as it is usually run means more compromise. Some students can go faster than others, and often a class of trainees is slowed to the pace of the slowest. Sometimes two or three individuals dominate the class, ask and answer all the questions. The instructor never knows if the other students are learning until he sees the results of the first test.

Now there are tests and tests. At best, they cover only a sample of the facts the trainees should have learned. So a test may in some cases show how much a student has learned and in other cases it will not.

There are other hazards which prevent rapid and thorough learning. One of the most common is a poorly chosen instructor, one who does more to confuse than to clarify the subject. Instructors are chosen very often because they know the subject, without regard for whether they have any ability to explain and teach it. I believe that a teacher must know his subject, but also that knowing the subject does not necessarily make a good teacher.

Private Tutoring

Perhaps some of you have had the experience of receiving private tutoring from a good tutor, one who really knows his subject and knows how to teach. Then you were the sole object of his attention, and every question he asked was yours to answer. The good tutor soon knew whether you had a good grasp of the subject or not, and developed his remarks and questions accordingly. He adjusted his presentation so that you were able to learn at your own pace. You were neither held back by other students who learned more slowly nor pressed to go faster than you could, by the progress of more advanced students in your class.

Now I will not go so far as to claim that any teaching machine is as good as a good tutor. But for some subjects a well-planned text presented in a good machine approaches the situation of having a private tutor. Especially is this true when the students are well motivated, are really anxious to learn. Certainly this is the situation in a big company when we carefully choose candidates for a new endeavor in the organization, and they know that a raise or promotion depends on how quickly they learn the new work and become productive on it.

Essential Features of the Teaching Machine Idea

The terms, "teaching machine," "automated learning," and "programmed text," need some clarification. At first it is easy to think that the *machine* is the all-important feature of the new technique. However, this is not the case, in my opinion. A mechanical device may be very helpful but it is not the necessary element.

The essential features are two. First in importance is the carefully developed sequence of questions or statements called the "program." The learner must make a definite response to each step before proceeding to the next.

Second is the fact that the learner is told immediately whether his answer is right or wrong. There is evidence that the most effective program is one to which the learner responds correctly at every step. The reward of being right constitutes "reinforcement" of the fact in his mind. Since the steps or "increments" of knowledge are small and many, each requiring individual response, there is opportunity for almost continuous reinforcement.

Programs

An incremental presentation, properly constructed, leads to more complete learning. It brings the student along to a gradual mastery of the subject as he progresses from simple to increasingly difficult increments. Meticulous text preparation leaves no gaps or ambiguities to impede understanding.

This sort of text called a program may be presented in book form or by certain types of mechanical devices. But in either case the important thing is the preparation of the text, however it may be presented.

Scrambled Book Approach

I'd like now to describe some of the forms of presentation.

First, let's consider the "scrambled book." Let us consider a few pages from a book called "The Arith-

metic of Computers," prepared by Mr. Norman Crowder for use in training programmers at the Systems Development Corporation, and published by Doubleday. This book is intended as the student's first introduction to this subject, not an auxiliary to other texts which have to be read first.

The purpose of the book is to provide the reader with a useful knowledge of the number systems used in electronic computers. The presentation is as nearly as possible a set of alternative conversations between a teacher and his pupil. But it is not an ordinary book; although the pages are numbered in the usual way, they are not read consecutively. The book offers information in rather small units, and tests the reader's understanding by means of multiple choice questions; and each answer is tagged with a page number. The reader must answer the question in order to proceed further in the book. After the reader chooses an answer, he goes to the page corresponding to the answer he chose, and there finds out if he was right or wrong. A wrong answer leads to more discussion of the same point of information and refers him back to make another choice. A right answer leads the student to the next unit of information and the next question.

This may be enough explanation to show how the "scrambled book" or "TutorText," as Mr. Crowder calls it, may be used. Besides the book, a machine has been designed to take the place of the book. It is a projector for 35 mm. film. Each page goes on a single frame and may be projected on the screen. A single roll of film will hold 10,000 frames or pages, which is the equivalent of several books. The book, for instance, has 472 pages and is about an inch and a half thick. So 10,000 pages would be a pile of paper nearly four feet high.

When you use the machine and wish to go to a certain page, you merely punch out the page number in the keyboard, hit the motor bar, and the machine spins the film to the desired page. You can say, I suppose, that the machine is just a very expensive page turner. But you must admit that it is a very convenient one. It is also capable of turning itself into a moving picture projector and of accumulating totals of right answers on first attempt or of total time for a certain sequence, if such scores are desired.

There is no denying that the machine adds cost to this method of training. But it also adds "glamour," and makes the process more interesting. I might add that Mr. Crowder's employer, U. S. Industries, Inc., is now offering a less expensive machine, a sort of "compact" model.

This therefore is an illustration of one of the two main schools of thought in the field of mechanized training. This was the "Multiple Choice" method, and clearly it is much like multiple choice tests which have been in use for years.

Skinner Approach

The rival method is often called the Skinner approach after the well-known psychologist, Dr. B. F. Skinner of Harvard. Skinner insists that the student "construct" an answer for each question, and claims that this is much more effective as a learning process than the Multiple Choice method.

It appears that more machines have been designed as copies or revised versions of the original Skinner machine than have been made to implement the Multiple Choice approach. A good example of a Skinner-type machine is the "DIDAK 501," made by Rheem Califone Corporation, Los Angeles 28, Calif. For use in this machine, incomplete sentences and answers are printed successively on standard letter-size paper. The sentence to be completed is spaced so that it alone shows in the aperture on the face of the machine. After completing the "fill-in," the student turns the knob, which advances the sheet bringing the answer into view while his own answer is still visible. Thus, he knows immediately whether his answer is right or wrong.

There are strong partisans for each method and the experts are divided. The General Atronics Corporation, of Philadelphia, have experimented with various devices and have favored the "multiple choice" approach. Their Vice President, Dr. Robert Roop, now says that he is planning a combination approach. This seems to me to be a very sensible thing to do.

Dr. Roop's most recent device uses what he calls the TAG (Teaching and Grading) System. For this system the program is printed in book form and the student records his choice of answers by perforating the answer sheet with ball point pen stylus. The answer sheet is clamped in position over a template with shallow holes for wrong choices and deeper holes for right answers. As the student pushes the stylus through the sheet, he knows at once if his answer is right or wrong by whether the stylus is stopped or penetrates deeply. The type of hole in the answer sheet is a permanent record of his choices.

Room is provided for "fill-in" answers at the top of the sheet. Here the device does not contribute anything except as a sheet holder. The correct answers are to be found on the next page of the text.

Programming

Dr. Roop is planning a course in programming techniques, programming for teaching devices, that is. The need for good programs is now the greatest obstacle to the expansion of the use of teaching devices—the need for well-constructed and tested programmed texts.

To produce a good program is usually thought to require a person trained in psychology. But if the knowledge of how to produce a good program can be conveyed to others so that any of us, after special training, can write effective programs, a great step forward will have been taken.

Much of the experimental work that has been done has pertained to teaching at the elementary or secondary school level. Some important research has been done in the Roanoke, Virginia, school system. The most notable result seems to be their experience in teaching Algebra to ninth graders. Those using the "Automated Course" finished a year's course in one semester, and also stood high in examinations given on a national basis, indicating that their grasp was better than average even though only half the time was spent.

Programmed Books

At Collegiate School in New York City, the country's oldest private school, a great deal of experimental work has been done over the past three years. The use of incremental texts has proved very successful, both with outstanding students who can forge ahead at their own pace and for retarded students who need to spend more than average time. It is of interest to note that at Collegiate School the mechanical devices have been largely discarded. They feel that the various forms of printed texts in incremental form are just as effective without the machine.

In line with this comment, mention should be made of an experimental text recently published by Harcourt, Brace, called "English 2600." This is a text in grammar and English usage. It is a paper-covered book about an inch thick and each page is divided into six sections. A section on page 1 contains a statement with a blank to be filled. The student writes his answer and turns to page 3. There he finds the correct answer and another completion statement, in the corresponding section of the page. He turns to page 5 and again finds the correct fill-in and another "question." Thus, he proceeds along one "band" of the book, right through to the end. Then he starts through again on the next band, repeating until he has covered all the odd pages. Then he starts on the bands on the even pages. The reason for the number "2600" is that there are about 2600 programmed steps in the book. This appeals to me as one of the simplest systems I have seen.

Programmed Machines

At the other end of the scale is the experiment at the Systems Development Corporation where an experimental project is using an entire electronic computer, hooked up with a random access slide projector of their own design. Using this arrangement, they can carry out many kinds of experiments, including such possibilities as making the successive frames of text easier when the student has not done well, all this under the control of the computer. This leads to conjecture as to whether computers may not be used to tailor, automatically, the text to the individual needs of a whole roomful of students.

Automated Teaching of Computer Programming

My main interest is the use of automated teaching of technical subjects, in particular, computer programming. I know of research being carried out by both International Business Machines Corp. and Radio Corp. of America in using incremental learning techniques for training, but in neither case do their own computers seem to have any active function in training.

RCA has quite an enthusiast for the Skinner approach in the person of Lon Grace, who has designed and built a machine which he is now using in experimental teaching of their "Scientific Interpreter" for the RCA 501. He is making some preparations to teach COBOL, the "Common Business Oriented Language," which is expected to be the universal system for describing a procedure so it can be put on any computer.

IBM has apparently had good results with the research projects in the subject which they have carried out. Their first and main use so far has been in training Customer Engineers, where early results show that the job can be done more thoroughly and with less total time spent by the students when a programmed text is used. They have also tried out the technique in teaching classes in computer programming for the Type 7070 machine. Here, with 70 people in 6 classes using the new technique, and with 42 people in 2 classes as a control group not using the new technique, they report that the experimental group averaged 95% in an exam given after 11 hours of training, while the control group averaged 86% after 15 hours of training. They consider the experiment a success so far, but will not be ready to report any final results for at least another six months.

The kind of action I hope IBM will take is to furnish tested text material to their customers for teaching all phases of programming. I would hope that this material would be made available in a form which can be used with one of the simple teaching machines.

If, in our Company, we are able to assign a new recruit to be trained in computer programming, and if we can let him train himself at his own pace, without waiting for a class, and without being held back by a poor instructor or slower-to-learn students, our present cost of training will be materially reduced. We have a large staff on this work and a high turnover rate, so the cost of training is a considerable item. The cost of sending people to class is easy to measure, but the cost of slow production while they are learning "on the job" from other more experienced people is very difficult to assess. As we get more and more into technical methods of operation, the need to modernize our training methods becomes increasingly important.

For background knowledge on this subject, let me refer you to "Teaching Machines and Programmed Learning" by A. A. Lumsdaine and Robert Glaser, published by the Department of Audio-Visual Instruction, National Education Association, Washington, D. C., 1960, Library Congress Card #60-15721, 724 pages, a combination of 47 useful and/or important articles, with supplementary information.

Importance

In my opinion, the teaching machine, defined broadly enough to include the whole field of programmed texts and incremental learning, is not just a fad and a passing fancy of the psychologists. Rather it is an important development in which we should all take an interest and with which we must become intimately acquainted.

Neither in schools where our children's time is more and more at a premium, nor in industry and clerical activities can we afford to waste the centuries of time that are going down the drain with today's training methods!

The Trouble With Commercial Compilers

John H. Hughes
Assistant Vice President, Data Processing
American Mutual Liability Ins. Co.
Wakefield, Mass.

A number of artificial languages (technically called "source languages") have been designed to make it easy to describe business processes in such a way that the description is susceptible to computer translation into the computer's instruction language (technically called the "object language"). Some of the source languages bear the names FLOWMATIC, COMTRAN, FACT, COBOL. The computer translation takes place under the control of a program called a "compiler."

These artifical languages have one thing in common: they all make use of English words and sentences. It is my contention that this is not, as is often claimed, their principal virtue. On the contrary, it my thesis that the chief weakness of commercial "English language" programming systems is, in fact, their attempted use of English.

Should You Write Programs in English?

Let us consider for a moment the principal claimed advantage of English language for source programs. English is spoken, written, and understood by practically everyone who matters to the manufacturers of large-scale computers. So, computer marketers would have us believe, it is unnecessary for the user of a large-scale computer, with its associated English language compiler, to learn a new programming language —he can write his programs in good old familiar English. In fact, the English "understood" by computers is not the English spoken by you and me. It is comprehensible to us because it uses some of the same words and some of the same grammatical structures.

But we cannot claim to have a "speaking" knowledge of this language until we have learned its restrictions. Here a conscious effort of learning is required, just as a conscious effort is required to learn, for example, that other artificial segment of English called Basic English, the simplified English using a basic 850 words devised by C. K. Ogden, of Oxford University. In learning Basic English, a foreigner has a marked advantage over a native English-speaking person, in that he is never tempted to use English words that lie outside the permissible vocabulary, because he does not know them. But if you or I try to speak Basic English, we must make a constant effort to avoid words which lie outside its vocabulary but which are temptingly convenient, concise, and precise. Computer English, then, does require learning. It is simply not true that an untrained person can sit right down and start programming a large-scale computer by using an English source language.

Redundancy of English

Another feature of spoken or written English is its high degree of redundancy. Of the possible combinations of letters or sounds, only a very small proportion constitute allowable combinations. For this reason misspellings and mispronunciations, while they may cause an emotional reaction detrimental to communication, present no serious technical block. U cn rd nd unnerstan a sntnce ritn lyk ths wun w ev bit s much accrcy as th prev sentnce. This is because you have an ability as yet scarcely within the reach of computer programs, to recognize common phrase and spelling patterns and to compensate for the distortions that may be present. To program a computer to be insensitive to bad grammar and spelling is conceptually possible, but probably a waste of time. So, "computer English" loses the advantage of ordinary English's redundancy, i.e. the ability to communicate reliably despite noisy channels, while retaining its disadvantage, lack of the conciseness which could be achieved if the size of the universe of possible messages were restricted.

Looking at the matter of language from the point of view of the computer programmer, then, computer English fails on two counts: it is difficult to write precisely enough for comprehension by the translator (compiler) program and it takes too much writing to express a simple command.

Length of Program

The program, once reduced to computer English, must be transferred to a machine-readable form (cards, paper tape, or magnetic tape) for the translation program to operate on it. Again, the same failings plague us. The great length of the source program increases the probability of transcription error, while the requirement for precision makes such errors costly.

The Illusions of Upper Echelons of Management

With the limitations I have described so hampering its usefulness and efficiency as a source language, how has English language programming (computer English) reached the position of importance it now occupies in programming technology? Sad to say, I believe this has happened because most of the people who have to make decisions about the purchase of computer equipment for commercial use do not have the faintest idea what they are doing. (This is because the computer business is so young that hardly anyone has yet had time to move through a work experience of practical programming into a position of executive responsibility.) To them, the illusion that by obtaining a computer with an associated English Language Compiler they can avoid selling their company down the river to a bunch of technicians has enormous sales appeal. So they decide to go ahead, using FACT or FLOWMATIC or COMTRAN or COBOL. And the programmers suffer. Those who are of necessity trained in machine, or near-machine, language are agonizingly aware of the sacrifices in program efficiency

that are made to achieve a compiler that can be implemented. Those who write in the source language soon become aware of the sacrifices in programming efficiency that are made to achieve a language which "members of the upper management echelons can read and understand."

Do these "members of the upper management echelons" really gain anything from the use of "English" Source Programs? I doubt it very much. The source programs are still written in a degree of detail that should be of no concern to upper management. The essential facts about a system must still be presented to upper management in broad-brush terms having little relationship with the computer English of the source program.

How about the immediate supervisor of a programming group? If he knows his business thoroughly, the English language is likely to irritate him by its inefficiency. He may approve the use of an English Language Compiler because it allows him to get working programs written by programmers whose machine language efforts might well be no more efficient, or because it lessens somewhat the need for programmers with the rare turn of mind and personality that can enjoy making a computer "sit up and talk." He is unlikely to be happy with the sacrifices that must be made, and he will recognize that the power of such a compiler arises not of but in spite of its use of English as a source language.

Progress by Abandoning Computer English

The FACT Compiler, of Computer Sciences Corporation, which is being implemented for the Honeywell 800 computer, overcomes partially the disadvantages of the English language by abandoning it for the expression of the input editing and report writing requirements of a system. The next logical step, I believe, is to abandon it in favor of a less redundant code for the intermediate phases of the system.

I should like to propose here, then, that the efforts of the Applied Programming Groups now working on English language compilers be diverted to working on compilers for a new language designed to have the advantages of English without its disadvantages.

For example, the new language should avoid the use of unnecessary connectives (those implied by verbs). It should have a vocabulary of verb abbreviations easy to learn but not readily confused with their true English counterparts. The vocabulary should include verb abbreviations for common data processing actions for which no single verb today exists. To satisfy the demand, such as it is, for program records in computer English, the implementation of the new language translator could include a retro-translation into unabbreviated regular English.

No Sacrifice of Real Advantages

The following very real advantages that English language (and other) compilers have need not be sacrificed in the implementation of this new compiler.

1. It is generally true that English language compilers require the programmer to describe the file organization or "layout" in a fairly concise "language" defined for the purpose. At the time of file description, the correspondence between fields in the file and their English names as used by the programmer in his English language programming is established. In naming the fields the programmer can decide for himself whether he wishes to use full names or abbreviations. The important advantage gained is that the file description is available to the compiler during compilation of any run using the given file. The programmer does not have to consider the layout in detail and can refer to fields by name with the assurance that generators within the compiler framework will provide addressing and masking as required. There is nothing in this process that is peculiar to an English language compiler, although the problems of implementing an English language compiler gave impetus to its invention.
2. The vocabulary of English language compilers can include verbs representing operations which involve many machine instructions, e.g., "GET next A-file item." That "GET" covers a multitude of sins. This is merely to say that the commands of the English source language are Macro-instructions, but Macro-instructions are by no means peculiar to English language compilers.
3. The fairly concise non-redundant methods used for expressing input and output edit requirements which some "English Language" compilers resort to can and should be retained.

Finally, a business oriented compiler should permit facile inclusion of machine, or near-machine, code. There will continue to exist functions which are practically impossible to generalize efficiently. Table storage is an outstanding example; most tables can be stored far more efficiently if the word structure of the particular machine is understood and taken advantage of, and the increase in efficiency may amount to a factor of five.

The title of this paper is, to catch your eye, "The Trouble With Commercial Compilers." The trouble is not, as I think you can see, a basic one. But let's stop deceiving ourselves that the English language has any virtue of its own as a language for writing source programs, and let us concentrate on designing a source "language" whose redundancy is only as great as may be helpful in making it easy to learn.

COMPILER: A computer program which directs a computer to translate a program written in a problem-oriented or process-oriented "Source Language" (the Source Program) into a program recorded in machine language (the Object Program).

PROGRAMMING SYSTEM: A programming language plus the compiler or assembler needed to translate the source program into machine language.

REDUNDANT: A message is redundant, if it contains more information than is needed for the recipient to distinguish which member of the universe of possible messages is intended. Any message which can be shortened without loss of intelligibility is redundant.

The Coming Technological Society

Dr. Simon Ramo
Executive Vice President
Thompson Ramo Wooldridge, Inc.
Los Angeles, Calif.

(Based on an address delivered at the University of California, Los Angeles, May 1, 1961)

We are all aware today that we are in rapid transition to a new, highly technological society. The possibilities that will unfold and the problems that will arise in this new age ahead will present many challenges to the scientist and engineer. However, these challenges will not begin to compare with the new opportunities that scientific advance will open up to society as a whole.

The New Technological Society

What will the new technological society be like? There is already a gross imbalance between technological and sociological progress. In view of this, will the transition to the new society be orderly or chaotic? Civilization will have to absorb the impact of science and technology. We do not really have a "take it or leave it" choice. For one thing, the increasingly fast-paced, complex, and interacting world, with its rapidly expanding population, urgently requires solutions to the problems of its physical operations of production, communication, transportation, and resources control and distribution. Because technological creativity and scientific advance are able to do so, they are furnishing the answers to these kinds of problems. In other words, on the material front, a match between the need for solutions and the ability to formulate solutions exists, so science and society are through with their courtship and are now getting married. Will it be wedded bliss, with the offspring sources of pride and joy, or will it be a shaky, unstable partnership?

Technology has clearly become one of the dominant factors in determining the nature of the world. Of course, we cannot expect to completely understand the world ahead by viewing it solely from a technological point of view. Yet, in this lecture, I shall be doing just that, looking at the future from the admittedly narrow viewpoint of a technologist. This is useful to us, I submit, only if we agree at the outset that there is much more to it, and that the ultimately needed projection is one that will include the sociological factors as well. And look ahead we must, because despite the fact that much of what will happen is fixed and, in a sense, beyond our control, there still remains that great fraction that we can do something about. To a considerable extent, we can have a better world in the future if we know what we want, or if we recognize what we might otherwise get.

The Hydrogen Bomb

The H-bomb is the established symbol of the growing disparity between rapid scientific change and the lagging adjustment of society. We need to note only that we have learned how to release quickly such tremendous amounts of energy as to be able to destroy all civilization in a world that has not yet produced an accepted, respected mode of conduct to preclude the use of force. On the other hand, control of tremendous amounts of energy suggests great benefits for society. We should be able even to influence the earth's weather and the gross features of its terrain.

Of course, aside from the fact that large-scale energy release has peaceful as well as warfare applications, the bomb is not the best example of the impact of technology. It emphasizes the military side of the world's problems, whereas, even if no war danger existed, disorder would still threaten if we should fail to assimilate the technological revolution.

Outer Space

Outer space is the newest symbol of the influence of science on world affairs. We are preparing now for a period ahead in which we shall eventually become a "three-dimensional-space" civilization, rather than being limited as now to the thin film of air over the surface of the earth. Today, all of the things we are doing in space, either for military or for peacetime pursuits, are no more than extensions of our surface civilization. We orbit equipment around the earth to assist us with our tasks of control of the operations of our present civilization. Or, in reaching out to more distant space, we are merely probing to learn the facts about it. But surely no one doubts that this is the beginning of a new chapter in the history of man which must include, before many more pages are written, the ability of man to colonize in a limited way the moon and the near planets if he chooses. And if we put ourselves into a science-fiction frame of mind, he may even succeed in creating artificial, inhabited, permanent planets in various orbits about the sun as preferred by their adventurous dwellers.

Outer space, as the latest major example of the impact potentials of scientific advance, illustrates not only technological innovation but the problems of adjustment in our pattern of life on earth that come with it. For instance, where in space do national boundaries end? How will the world go about judging the contest for use of the limited radio spectrum, as satellite communication repeaters make possible the wholesale interconnection of world communications into a single, endless, earthwide web? What political bodies and agreements will decide how space technology and meteorology will be applied, not only to predict but ultimately to influence the earth's weather by using nuclear energy? How can international cooperation, which seems so sensible for proper exploration and exploitation of space, be arranged?

Intellectronics

Nuclear energy developments and outer space conquest will change our way of life. So also will new chemical and biological discoveries. Large increases in man's life expectancy may conceivably occur be-

fore the twentieth century is over. But, meanwhile, there is another area of science and technology already emerging, I submit, as the most influential and important for the next decade or two. It will use the greatest fraction of our technical resources, will be most determining in international competition, peace or war, and will very probably emphasize even more the inequality between technological and social advance. A discussion of this area will thus help us especially well to understand the nature of the coming technological society.

The rest of this century will see the gross extending of the human intellect and senses by application of science and technology. In every intellectual pursuit in which man is engaged, be it in the professions, in production, in military command, in teaching—everywhere—when we analyze what we do with our minds, we find a part that is best assigned to electronic machines. Reduce the intellectual activity to stored and incoming information, to logical processes, sorting, deciding; and the part that is well understood, that involves rates and quantities too large for the human mind, assign to the machine. This frees the human intellect for the more complex aspects of the intellectual task, above the routine work of the electronic partner.

Give human beings the Great Pyramid to build without machines, and you will have a thousand slaves pulling a huge stone, an activity at once beneath man's dignity and his remarkable physical dexterities, and yet at the same time quantitatively above him. One man simply cannot produce more than a token part of the energy that is needed. Similarly, give a human being a series of single digit numbers to add, and he can perhaps do one or two combinations a second, and within a few seconds he will be so tired or bored that mistakes will be numerous. Just as a fleet of bulldozers, a huge electric motor, or an H-bomb can surpass by millions or billions of times the energy-producing capability of a human system, so electronic devices can outdo by millions or billions of times the capabilities of human beings for simple, repetitive, intellectual processes.

The human brain consists of the equivalent of perhaps ten billion electron tubes or transistors in a cleverly flexible and reliable, interconnected array. The human mental apparatus is a million times more brilliant intellectually than any machine that has so far been built or even conceived. Clearly, such a versatile intellectual capacity should not be applied to tasks that do not require it and that are satisfied by a relatively stupid intellectual machine that specializes.

Obviously, we are not talking about "automation," the replacement of the factory worker. The words "automatic control" and "computer" are also inadequate and narrow. We are speaking of a new man-machine partnership in the powerful domain of the intellect. I like the new word, "intellectronics," because it says in one word: extending the "intellect" by "electronics."

To show how deeply significant are the possibilities of electronics in basically routine intellectual activities, let us take some brief examples. They will be a bit futuristic, but even where I shall use some exaggeration to make a point, a serious underlying basis will always exist.

The Practice of Law

Consider the practice of law, or at least law as it might be practiced if intellectronics is used to the fullest. Two or three decades from now, every practicing attorney might have in his office a means for convenient electronic connection to a huge national central repository of all the laws, rulings, regulations, and procedures, and commentaries upon them, that he needs. He or his assistant will be able to query the central repository by operating an electronic input device looking a little like a typewriter. Almost immediately, there will be displayed to him on a special viewing screen any information that is available on his particular question. And this display will cover not just the few possibilities that an unaided, though trained, human brain might have produced in a few days of research in a law library. Instead, the intellectronics system will scan, select, and present in a few seconds the equivalent results of dozens of trained searchers covering many decades of records over the entire nation.

You can see that the intellectronics system—and we know how to design such systems today—will elevate the lawyer's intellect to the more complex intellectual tasks by giving him better tools with which to work. It will speed up a substantial fraction of legal practice. Even on the nonroutine, the more intellectual, legal questions, the attorney will be able to consult with the equivalent of a host of informed fellow attorneys. His request to the system for similar cases will yield an immediate response from the central repository, together with comments filed by other attorneys on those cases, even as he himself may later add his experience and ideas into the system for future use by all.

Legislating

The national intellectronics network to serve the legal profession can serve the law-making bodies of government as well, not only in the conventional fashion I have just described, but in two additional important ways. First, since any intellectronics system has to be based upon some kind of logical indexing of the information in its memory so that the information can be retrieved, the initial analysis of the input data for indexing purposes can be expected to emphasize any conflicts or omissions that may exist in the laws and regulations. Second, the intellectronics system can readily accommodate the mass of data available on the results of enforcement of the existing laws and regulations. Such comprehensive statistical data should disclose where existing laws and regulations are ineffective, and thus be of prime aid to our law-making bodies. The world is becoming ever more complicated, every action interacts with more, other actions; so the rules of our society are correspondingly becoming highly detailed and the procedures increasingly lengthy. Something new to cope with this situation, like an intellectronics system, seems imperative, not just desirable.

Medical Consultation

How many physicians can your doctor consult with? A practical answer would most often be: maybe two or three. The physician in the future technological age, towards which we are in such rapid transition,

(Please turn to page 18)

NEWS of Computers and Data Processors

"ACROSS THE EDITOR'S DESK"

"AUTOPROMT", NEW ADVANCE IN NUMERICAL CONTROL FACTORY PRODUCTION

International Business Machines Corp.
590 Madison Ave.
New York 22, N.Y.

A new computer language, designed to broaden the use of numerically-controlled machine tools for automated production of complex parts, was demonstrated on June 14 by this company.

Called AUTOPROMT (AUTOmatic PROgramming of Machine Tools), the computer language enables the user to describe the surfaces of the three-dimensional shape to be milled, instead of describing each path the tool must follow to machine the part. The program leaves to a computer the task of automatically generating the required tool paths on the basis of a simple description, in English-like terms, of the part to be milled and the tool to be used.

A "flying crane" helicopter's large gearbox cover with 20 shaped depressions be-

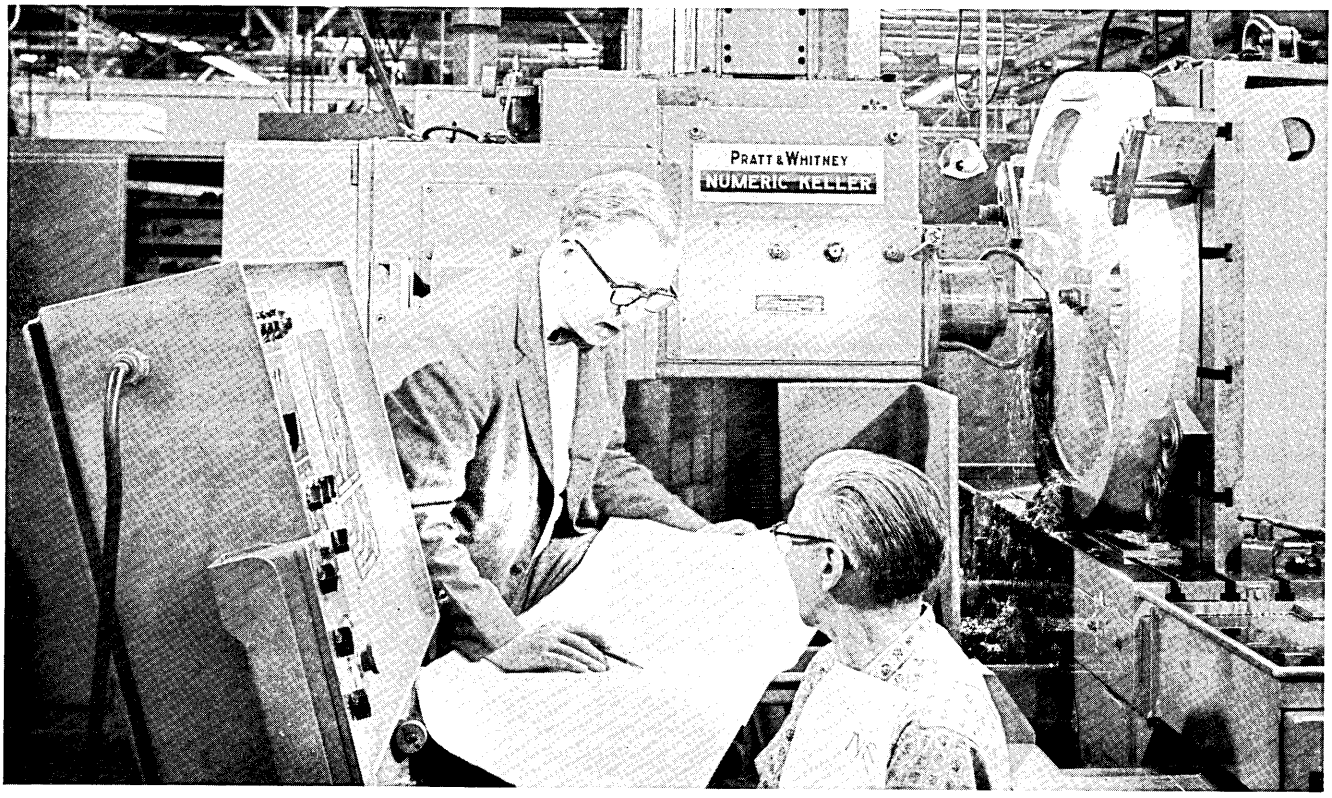


Figure 1 -- At the right is the helicopter gear box part, a large round slab of aluminum, with some of its depressions already machined. At the left is the operator's console. Not shown in this picture is the punched paper tape reader which controls the tool paths.

tween ribs was machined in the demonstration, using a Pratt & Whitney Numeric-Keller, a tape-controlled continuous-path milling machine, and a ball-pointed drill.

Deduced from a blueprint, 180 one-line statements in the AUTOPROMT language were written to describe the part completely. Then a solid-state IBM 7090 computer -- using this information and controlled by the AUTOPROMT master program -- generated more than 8,000 tool path instructions. They provided the Numeric-Keller with every tool motion required to machine one of the 20 depressions.

The computer's instructions, converted to perforated tape for use by the machine tool, enabled the milling job to be completed in about one-fourth the machining time previously required to mill the same part with conventional methods.

The saving in lead time is even greater. To produce this part by conventional methods required three months from blueprint to production. With AUTOPROMT, any part of similar complexity can be put into production in two weeks, one-sixth the lead time normally required.

```
SETPT =POINT/12.,0.,4.9
HOLE  =CONE,IN/AP(0.,0.,0.),AP(0.,0.,1.),SP(14.625056846,0.,4.97),  $
       SURFPT(7.952166554,0.,1.05)
BASE  =PLANE,+Z/NORM(0.,0.,1.),DIST(2.3)
START =POINT,LGX/INT OF (HOLE,TUBE2,SIDE1)
TUBE2 =CYL,IN/AXIS PT(0.,0.,0.),AP(0.,0.,1.),RAD(12.21)
SIDE2 =PLANE,+Y/NORM(.309017,.9510565,0.),DIST(.50)
TUBE1 =CYL,OUT/AP(0.,0.,0.),AP(0.,0.,1.),RAD(7.72)
SIDE1 =PLANE,-Y/SURFPT(0.,-.50,0.),SP(1.,-.50,0.),SP(1.,-.50,1.)

       REM/  SIKORSKY   REGION 3
       FROM/SETPT
       REGION/SEQ(HOLE,BASE)
       XAT/ START,-Y DIRECT, RIGHT
       START BOUND/ HOLE(TUBE2)
       CB/ HOLE(SIDE2) BASE(SIDE2, TUBE1, SIDE1), HOLE(SIDE1)
       ZIGZAG
       GO TO/SETPT
       STOP
       REFPT
```

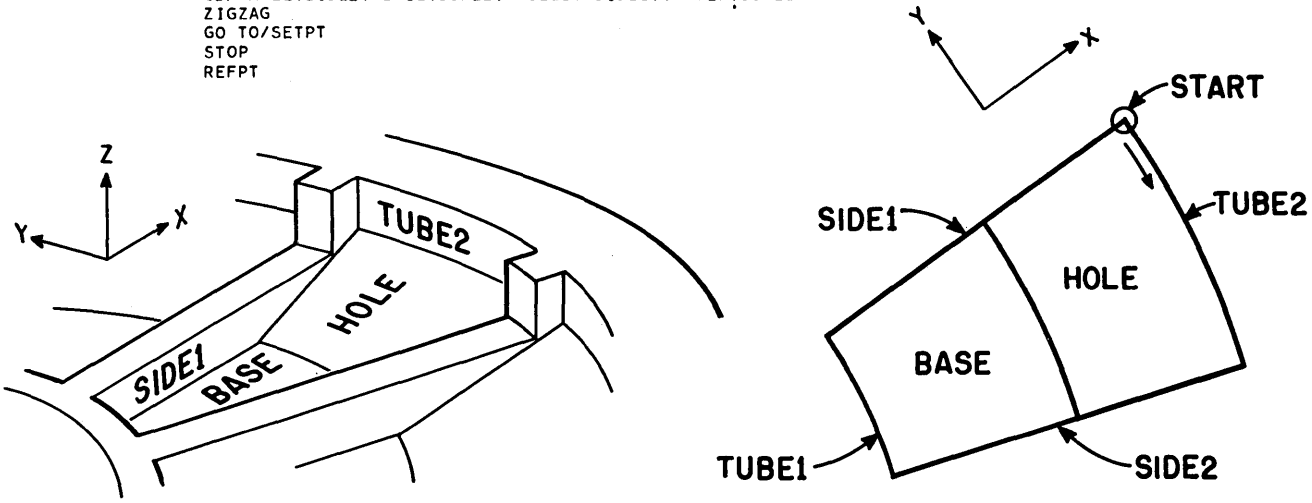


Figure 2 -- At lower left is a drawing of one of the depressions in the gear box cover. At lower right is a plan of the depression showing the names assigned to the surfaces. At upper left is a selection of the AUTOPROMT program showing the way in which the IBM 7090 computer is instructed in a relatively simple language so that it will produce the tool path specifications to control the machine tool.

NEW AIRLINE DATA PROCESSING SYSTEM TO HANDLE 180,000 RESERVATIONS PER DAY

The Teleregister Corp., Stamford, Conn.;
United Airlines, Denver, Colo.;
North American Philips Co., New York, N.Y.

The largest integrated electronic data processing system in the business world was officially put into service on June 2 by United Air Lines.

The system, which has been named "Instamatic," provides one of the fastest and most accurate reservations service so far developed. 3000 United Airlines sales agents in 100 locations from coast to coast can make reservations under conditions in which 80 per cent will be handled in less than one second. Formerly it required up to 45 minutes for each transaction.

The system was produced by The Teleregister Corporation. In size, it is exceeded only by the United States government's early warning defense system.

The first phase, systemwide space availability information, went into effect June 2. The second phase, which will provide for space inventory records, flight information, and other capabilities, is to become operational in September.

Eventually the system will handle reservations at the rate of 180,000 per day. It took 33 months to build and install and cost approximately $16,000,000.

The equipment includes three solid-state electronic data processors, 827 counter-top sales agent sets, and 150 tons of communications equipment. This equipment is linked by 12,000 miles of communications circuits.

The three data processors (Telefiles), are located at United Airlines' new $700,000 Reservations Control Center in Denver, Colo.

Information on the availablility of seats on each United flight up to one year in advance can be stored by the Telefiles on magnetic drums.

The central processors will be capable of instantly relaying information to sales agents regarding the on-time status of flights -- whether a flight is on time or late and if late, how many minutes and the reason for the delay. They also will be capable of automatically keeping records on magnetic tape of all transactions and producing reports for evaluation of traffic. Such questions as when to add extra sections to flights, or when to reschedule flights as required by traffic demands will receive immediate answers.

The high speed communications units are located at reservations centers in 15 major cities interspersed on the 12,000-mile network. This equipment, supplied for Teleregister by North American Philips Co., Inc., automatically routes the reservations data to and from the Telefiles at Denver and the sales agent sets. The data travels at a rate equivalent to 1,300 words per minute via high speed American Tel. and Tel. telephone lines.

Intricate communication devices included in the network automatically check errors, determine message destinations, locate operating irregularities, and reroute traffic in case of line failures. The system is interconnected by 12,000 miles of leased circuits.

The new transmission and switching system is one of the most advanced of its kind in existence and provides a very high degree of reliability. Approximately 500,000 transistors, 40,000 printed circuits, and 2,000,000 ferrite cores were used.

To assure maximum accuracy, the entire high speed communication system checks itself regularly every second. Should a fault occur in any one of the circuits, it is quite probable no agent would be aware of the situation, because re-routing to functioning lines is extremely fast.

Major equipment is duplicated. The standby principle of operation provides instant changeover; alarm devices indicate the exact location of the trouble. The design eliminates a great proportion of flight booking errors made up till now -- this permits greater seat occupancy at all times.

Inquiries from passenger stations on the main loops receive answers via the Norelco units in an average time of 1 second. On tributary lines which are tapped to the loops at certain points, the process takes 5½ seconds.

The high speed data transmission and switching stations are called concentrators. Each passenger-booking location has a push-button desk-set that is connected to a concentrator only during the momentary period required for the inquiry and reply. Each concentrator can serve up to 150 such agent sets. The system is capable of further expansion to handle the requirements imposed when United Air Lines absorbs Capital Airlines.

The system can detect errors in messages that are being transmitted. In such cases,

the equipment sends back an error reply to the agent set from which the inquiry originated -- or it can send back a repeat request -- depending on the type of message. The double check provides a highly effective method for detecting all types of transmission errors. Concentrators also operate in seconds to cut out a faulty section of line in a loop, rerouting the traffic via the good section of line on each side of the fault. When trouble is eliminated, the concentrators immediately close the loop and return to the normal operating arrangement.

The new system can accommodate many types of transmission codes, including five-level teletype, six bit computer code, and those commonly employed for punched card operations. Speed of transmission depends on the codes used, message length, and other factors. Line loading on the new United Air Lines flight reservation system will probably not exceed 60% and the time needed to get a response to an inquiry at concentrator locations will average one second or less.

"TRAGIC WASTE" DUE TO "MODEL T" MANAGEMENT OF INFORMATION ON CURRENT FEDERAL RESEARCH INDICATED

United States Senate
Committee on Government Operations
Subcommittee on
Reorganization & International Organizations
Washington 25, D.C.

The Federal Government's "Model T" methods of managing scientific information contribute to unknowing duplication and "tragic and intolerable waste of men, money and material," Senator Hubert H. Humphrey, (D., Minn.) declared in April.

He urged Federal Agencies to master the "scientific revolution" in information control. He made the recommendation in personal conclusions to a 278 page report, issued by a Senate Government Operations Subcommittee of which he is Chairman.

Efficiency in $8.1 Billion in Spending Involved

The report states that there is no indexed inter-agency inventory of an estimated 160,000 projects, involved in $8.1 billion of current Federally-financed research and development projects.

Various Agency Information Systems are designed to cover at least part of this effort. But the systems are a "hodge-podge" -- "overlapping, underplanned, under-nourished and under-used," Humphrey states.

For the Federal Government to rely on present methods, he said "is no way to run a railroad or a race for survival."

Information Control Key to Man-in-Space

No administrator or scientist, however competent, can attempt to know personally about all current work in progress which is related to his field, the Report states. Yet, Senator Humphrey observes, "Knowledge of work in progress is a key to effectiveness in many fields -- to man-in-space, to control of the weather, probing the ocean depths, drilling into the earth's crust, bombarding the nucleus of the atom, deciphering the code of life, or unlocking the secrets of why plants are green."

The National Aeronautics and Space Administration has no central index of all its "in-house" and extra-mural research and development projects, now in process, the Report observes.

Science Information Exchange

It adds that partly because of the Senate Committee's urging, several Federal agencies, including NASA and the Defense Department, have organized a Science Information Exchange for the registration of "all" current research projects. However, the Exchange has hardly begun operations in the physical, social, engineering and mathematical sciences. Previously, the Exchange has registered 30,000 current projects in the biological and medical sciences. But, the Report states, agencies have not used even the medical coverage to its fullest potentiality.

The Report criticizes "lost effort" and unknowing duplication in Federal research and development: --

"Sufficient attention has not yet been given to the problem of salvaging results from vast investment in contracts and subcontracts which are canceled prior to producing finished hardware. More than $2 billion of such contracts and subcontracts were canceled in the last 3 fiscal years...Another of the important phases of the information problem concerns duplication of effort -- either on an intentional or unintentional basis. The Department of Defense does not have a reliable study on the extent of unintentional duplication, but some estimates run as high as 10 percent."

New procedures to salvage information from canceled contracts and to prevent unknowing duplication were urged by Humphrey in letters to the new Administration, shortly after the January 1961 changeover. At that time, the Committee on Government Operations approved the key points in the Subcommittee's report.

SOLID-STATE TUNNEL TRIODE

Bendix Corporation
Research Laboratories Div.
Northwestern & 10½ Mile Road
Southfield (Detroit), Mich.

Introduced for the first time in May, at the Bendix Research Laboratories Division's Symposium on "Information Processing and Computer Technology" was a new solid state "tunnel" device by Dr. H. F. Mataré, Research Laboratories scientist.

The new tunnel "triode" represents a major step forward in the use of high-speed tunnel-diode techniques, which have permitted computer memories to achieve extremely high speeds.

In the earlier use of tunnel diodes as memory elements, the act of retrieving the information stored in the diode caused the memory state to be erased, whenever the computer sought to determine the stored information. This required the "re-conditioning" of the diode each time in order to restore it to its original memory state.

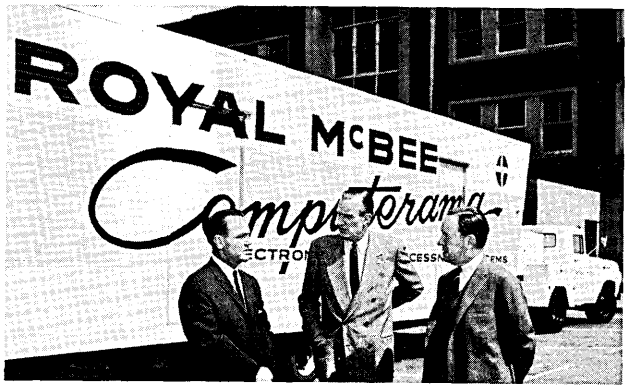
The new tunnel triode technique permits "non-destructive readout", because the third terminal can be used to sense the binary-state condition of the triode without affecting its memory content.

The triode described by Dr. Mataré makes use of certain properties of unipolar transistors invented and developed by him several years ago. This tunnel triode, or "unipolar tunnel transistor", appears to constitute a marked improvement over previous devices which attempted to sense the state of the tunnel diode. Previous methods were limited in speed (which is the main advantage of the tunnel diode) because of two effects known as carrier storage and relaxation. The unipolar tunnel transistor will be relatively insensitive to these effects and will, therefore, retain the high speed advantage of the tunnel devices.

MOBILE COMPUTER DEMONSTRATIONS FOR EXECUTIVES

Royal McBee Corporation
Port Chester, N.Y.

Three Royal McBee officials were on hand at the end of April for the dispatching of the first of four, mobile, 50-foot-long "Computeramas", which are now beginning a 100,000 mile-a-year tour of American cities. The market for electronic computing equipment now reaches to companies of all sizes, and selling in this market requires the adoption of a highly flexible technique for marketing by adequate demonstration the complex data processing equipment, even if small-scale. The Computeramas will provide demonstrations to executives of electronic computing and data processing equipment. Two Royal Precision computers and data processors, one LGP-30 and one RPC-4000, are housed in each trailer. They will be taken literally to the doorsteps of businesses, research, and scientific organizations, government agencies, and universities throughout the United States. About 500 Royal Precision computer installations have been made to date.



FREE DATA-PROCESSING TRAINING COURSES

Philco Corporation
Computer Division
Willow Grove, Pa.

A three day seminar, designed specifically as an introductory course to data processing, has been scheduled for July 5, 6 and 7 by this division. The sessions will be held from 8:30 A.M. to 10:30 A.M. Eastern Daylight Time in the Computer Division's facility at 3900 Welsh Road, Willow Grove.

The course is primarily designed for operating, supervisory and secretarial personnel to acquaint them with the basic elements of data processing. There is no charge for the seminar. Enrollment can be made by writing to C. A. Leventhal, manager of customer education, Philco Computer Division.

MERGING OF PLANT AND OFFICE AUTOMATION

George M. Muschamp
Vice President, Industrial Products Group
Minneapolis Honeywell Regulator Co.
Minneapolis, Minn.

(Based on a paper given at the 5th Conference on Manufacturing Automation, Purdue Univ., Lafayette, Ind., April 17, 1961)

A new era in industrial automation, in which automatic controls in the plant will be "married" to data processing equipment in the office, is in the offing for U.S. industry.

The successful consummation of this marriage could constitute the greatest industrial event of the 1960's.

The effects of this marriage will be to produce more goods more economically, to provide more of the types of jobs that can be done better by people, and to require more education to fit people for these jobs.

The issue may prove to be the most important confronting every major industrial enterprise. For management, it will mean more work, if we are to bring this wedding off as an economical union and not as a costly collision.

Automatic operations in plants and offices already have attained a high degree of development. It is possible now to merge these two massive developments.

We can reorganize the paper work -- the present end product of most automatic office equipment -- so that the information, in addition to serving as a record, can be fed automatically into plant control systems.

We can automatically acquire from the process both the information needed for automatic control and the information needed for accounting. We can automatically feed the necessary information back to the process for automatic control. This will lead to parallel automatic operations in place of the present man-machine serial operations.

It is becoming more and more difficult to draw a clean line of separation between automatic control in the plant and automatic data processing equipment in the office.

The immense challenge before management is to minimize the intolerable and costly overlapping which will occur if we continue the separate pursuit of plant and office automation.

While automatic operations for a whole enterprise can become complex, they can be built step-by-step. An example is provided by one of the nation's largest electric companies, Philadelphia Electric.

The company is installing an on-line digital computer whose primary function will be to direct the network control system to make certain that power is always produced at minimum cost. But the computer also will perform a secondary function by obtaining basic data for billing of power exchanged between interconnected companies.

MEETING ON COMPUTER STORAGE ALLOCATION

A. W. Holt
Chairman, Storage Allocation Committee
Association for Computing Machinery
c/o Applied Data Research, Inc.
759 State Road
Princeton, N.J.

The Storage Allocation Committee of the Association for Computing Machinery held an open technical meeting in Princeton, N.J., on June 23 and 24, 1961, under the sponsorship of Applied Data Research, Inc. The purpose of the committee is to facilitate and encourage the exchange of information and to stimulate new work on the subject. The storage allocation problem is the problem of finding computational methods for carrying out part or all of the assignment, use, and control of all forms of information retention available in the environment of a computing system.

At the Princeton meeting, technical papers were presented on automatic storage allocation techniques and their applications to real-time systems. Discussion on the subjects, "Toward a Definition of the Storage Allocation Problem," and "Pre-planned vs. Dynamic Methods of Storage Allocation," were held.

MICROMINIATURE COMPUTER UNIT: PARALLEL ADDER

General Electric Co.
Receiving Tube Department
Owensboro, Ky.

A microminiature computer unit about the size of a package of cigarettes was demonstrated in March by this company.

The tiny computer showed the feasibility of using General Electric's TIMM (Thermionic Integrated Micro Module) concept for data processing systems.

The developmental model displayed was a three-bit parallel adder containing 16 NOR modules. The TIMM components themselves, arranged in stacks of four, are about the size of four cigarettes.

The TIMM components are radiation tolerant. They withstand both pulse and steady-state radiation with little or no effects, during or after exposure. Also TIMM circuits need very little power, only 240 milliwatts, in the case of the 98-tube display computer.

The TIMM concept is especially useful for applications requiring high-component-density equipment where radiation is encountered. These include computers used for guidance in missiles, for nuclear reactor controls and for satellite applications.

Designed to operate at 580 degrees C., TIMM circuits make use of the heat that would normally cause malfunction in transistorized computers.

Each of the 16 modules in the demonstration computer contained a triode, five diodes and two resistors. Thus, the three-bit parallel adder contained 130 components.

Although the demonstration unit was not packaged in optimum form, its component density is about 43,000 per cubic foot. Considerably higher component density is possible. The entire unit could be built into a space of 1.8 cubic inches which would represent an operating density of 125,000 per cubic foot. This estimate is based on a predicted packing factor of 30 per cent, including leads. Weight of the 130 components, plus spacers, was only 1.38 ounces.

COMMERCIAL DATA PROCESSING SERVICE ESTABLISHED BY A BANK

The Waterbury National Bank
Waterbury, Conn.
and
Bendix Corporation
Bendix Computer Division
5630 Arbor Vitae St.
Los Angeles 45, Calif.

The Waterbury National Bank announced in March that it has signed an agreement with The Bendix Corporation for lease of data processing equipment manufactured by the company's Computer Division. The bank is beginning a data processing project unique to banking in the United States, and is believed to be the first national bank to establish a commercial data processing service. This 'pilot-plan' operation has been authorized by supervisory authorities. Experience gained in this project may be used as a guide for the 13,000 commercial banks in this country.

To facilitate development of the service bureau, the Automated Accounting Center of Connecticut was organized as a division of The Waterbury National Bank. This division will furnish data processing services to companies, which, like the bank, can not afford to set up an installation exclusively for their own use.

The center's service will be sold on a time and fee basis to any business in the state, and in certain areas in bordering states. The bank will not furnish the services free in exchange for deposit accounts or increases in deposit balances. The service will be priced to be profitable to the bank, as well as economical to even small business firms.

To familiarize businessmen with the center's operation, a series of special data processing seminars will be conducted by the bank. These sessions will serve to introduce the new technology to many organizations which do not have computing machinery. The bank is hopeful that the project will stimulate the economic growth of the community and the state.

The data processing system is in the medium-price range (50,000 to 500,000 dollars), and will be linked into a magnetic-ink sorter-reader. In addition to processing information from punched paper tape and magnetic tape, the computer will process data read directly from magnetic-ink symbols and numbers pre-printed on checks, deposit slips, and any other paper of workable size and weight.

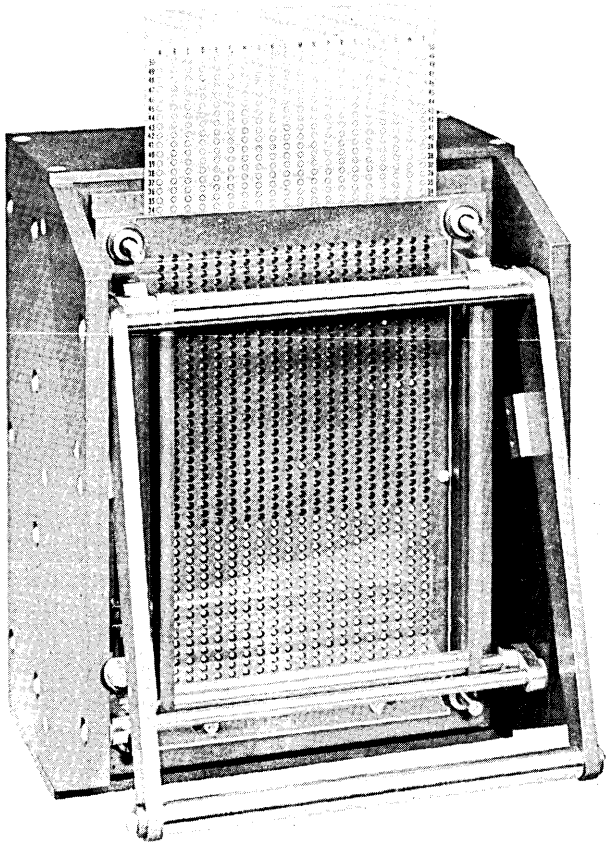
When all components of the system are fully integrated, two-thirds of the computing center's time will be used to process large quantities of business and industrial data. The remaining time will be utilized by the bank for its accounting work.

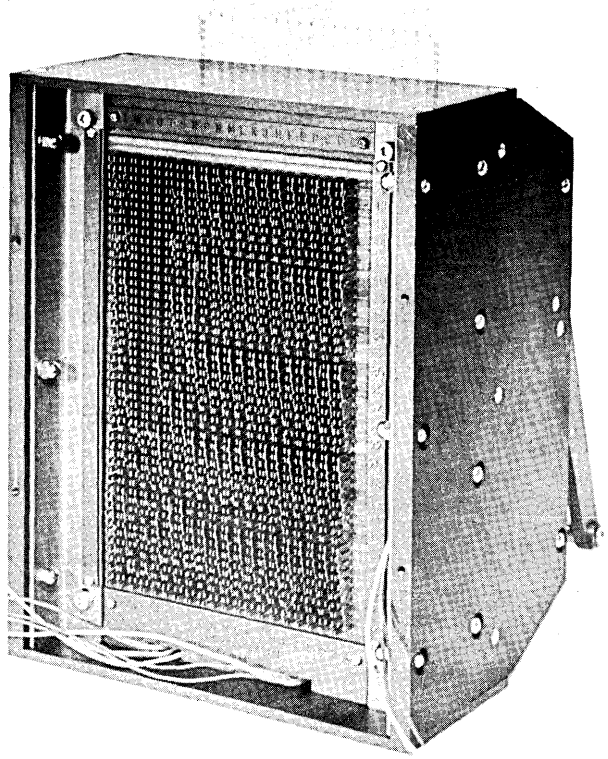
It is expected that the Automated Accounting Center of Connecticut will serve the following types of businesses: manufacturing concerns of all types and sizes; paper, brass, and textile mills; wholesale supply houses (industrial, building, food, drug, etc.); accountants; supermarkets; department and clothing stores; publishers; engineering firms; all businesses with delivery routes; utilities; insurance agencies; hospitals; banks; and many others.

1000 CONTROLLABLE SWITCHES IN LESS THAN ½ CUBIC FOOT

Taurus Corporation
Lambertville, N.J.

A new punched card switch has been developed by this company. The model K-1000 punched card switch provides 1000 switches operable from a card supplied by the company having twenty rows by fifty columns. There is a separate switch for each hole position. After the card is inserted and the operating lever is pushed, the punched holes have closed switches and the unpunched holes have open switches. The unit thus lends itself to automatic control of machinery, for example, where patch board programming has been found insufficient.





Many previous units of this type made by this company have been cycled over 100,000 times without failure. Units used constantly for over four years are still giving reliable and trouble-free service. This reliability is attributed to gold plating used over silver plating in the switch contacts.

APPLICATION OF AUTOMATION TO LIBRARIES TO BE STUDIED

Verner W. Clapp, President
Council on Library Resources, Inc.
1025 Connecticut Ave., N.W.
Washington 6, D.C.

A $50,000 grant to the Library of the University of Illinois Chicago Division has been made by this council, for a project aimed at helping university libraries in the age of automation.

The purpose of the project is to apply advanced data processing techniques to university library procedures, and to develop an over-all system using the latest electronic equipment, as well as to adapt business machines for library use.

The research staff will work with the Information Systems Division of the General Electric Co. on the project.

Many library procedures have not kept pace with the increasing number of patrons and the tremendous increase in the amount of information now available.

The number of titles published annually in the U.S. has increased 46% since 1929. Books classified as technical, which are those most used in university libraries, have increased 94% in the same time.

In the field of periodicals alone, it is estimated that more than 50,000 are published annually in 60 different languages.

The unprecedented growth in libraries has not been matched by the output of graduate library schools.

The subjects of the study include: (1) mechanization of cataloging procedures; (2) determination of the advisability of automatic compilation of a book catalog which would have general distribution on the campus; (3) dissemination of information to faculty and research staff; (4) microstorage of library materials; (5) an investigation of acquisition and circulation procedures.

AUTOMATIC DOCUMENT SORTING AND ACCOUNTING USING PLASTIC JACKETS

International Telephone & Telegraph Corp. (ITT)
67 Broad Street
New York 4, N.Y.

An automatic document sorting and accounting system for department stores and similar large retail establishments was described by this company at a recent convention of the National Retail Merchants Association.

This system is based on the "jacket concept", which uses a transparent plastic jacket to carry the original document or sales slip through the entire process.

All the information required for processing is coded on a strip of magnetic tape fastened to the jacket. Once an operator encodes information on the strip, the document is automatically inserted into the jacket and all subsequent operations are completed without manual processing.

The next operation is to sequence the jacket by account number in the classifier, which merges at a speed of 10 per second and sequences up to 3 or 4 per second. Again recognizing the information recorded on the strip of magnetic tape, the jacket reader transfers the data to a computer at a speed of 5 items a second.

The data processor: (1) calculates cyclic and control totals and various taxes; (2) updates the accounts receivable file; (3) produces aged account receivable reports; (4) prints customer statements; (5) processes changes to the accounts receivable file; and (6) produces management reports. It can also be used for payroll, accounts payable and inventory control.

When the information on the jacket has been fully processed, the document is automatically removed from its plastic protective envelope and stacked sequentially for later inclusion in the customers' statement.

Intelex points out that the new system requires no new sales floor procedures, retains "Country Club" billing methods, retains the present paper sales check, and provides the current credit status of individual accounts.

Another advantage lies in the fact that the original source document travels throughout the original system with its related electronic coding for reference and audit-trail purposes.

DIGITAL COMPUTERS USED TO PREDICT THE QUALITY OF METAL CASTINGS

Ellis Foster and B. L. Fletcher
Battelle Memorial Institute
Columbus 1, Ohio

Digital computers can now be used to eliminate trial-and-error experiments in predicting the quality of metal castings.

The key to computer analysis of castings is a method of accurately predicting the patterns of heat removal from a solidifying casting. With this established, almost every variable of the casting process can be evaluated on the basis of its effect on solidification and soundness of the ingot.

The first step in studying casting problems by computer is to describe the physical situation in terms of a mathematical model which can be used to predict the thermal behavior overtime of a casting under specified conditions. Once the computed predictions have been checked by experimental work, the mathematical model can then be used to predict the effects of altered casting procedures or shapes without further experimentation.

Computer analysis is especially valuable for intrinsically expensive cast metals like uranium and for cast metals like niobium and molybdenum which are easily affected by defects in the castings.

This analytical technique could also be applied to continuous casting, where it is inconvenient to vary conditions experimentally because of the large-scale operation; to developing specifications for shapes and sizes of risers by evaluating mold materials, pouring temperatures, and metal properties; and to heat treating by evaluating how long and at what temperature metal should be kept in furnaces or baths to achieve a desired result.

Fabrication processes also have characteristics that can be studied by the techniques. For example, the temperature attained by a forging is the product of the metal properties, the energy imparted in forming, the metal's initial temperature, and the heat losses by conduction, convection, and radiation. The mechanical properties also vary with temperature and the ability of a material to be formed may lie within a certain temperature range.

INVESTMENT FIRM USES COMPUTER TO PROJECT STOCK EARNINGS

Radio Corporation of America
New York, N.Y.

An electronic computer is at work performing the detailed statistical calculations of investment analysis for the Lehman Corp.

In cooperation with the RCA Electronic Systems Center at 45 Wall Street, N.Y., Lehman Corp. is projecting future common stock earnings for some 200 public utility companies. The earnings projection is one of the principal factors, among many others, used by management in making investment decisions.

The investment company provides the Center with twenty coded punch cards for each utility, containing 175 items such as energy unit sales, rate base, capital structure, rates of return, and cash flow, among others.

This information is converted to magnetic tape and introduced into the computer. The computer projects the common stock earnings for each company for the next four years according to a formula. To achieve the same results by conventional means would require a total of approximately 400 man-days.

Earnings projections of the various companies need be calculated simultaneously to be meaningful. So a new factor of efficiency has been introduced in the decision-making process affecting this important area of investment.

In projecting the common stock earnings both a rate base method and a unit sales method is used. Once the analytical work is programmed, it will be possible to feed updated information into the data processing system at any future time and print out the desired results in minutes.

MICROFILM SEARCH AT 100 PAGES A SECOND

FMA, Inc.
142 Nevada St.
El Segundo, Calif.

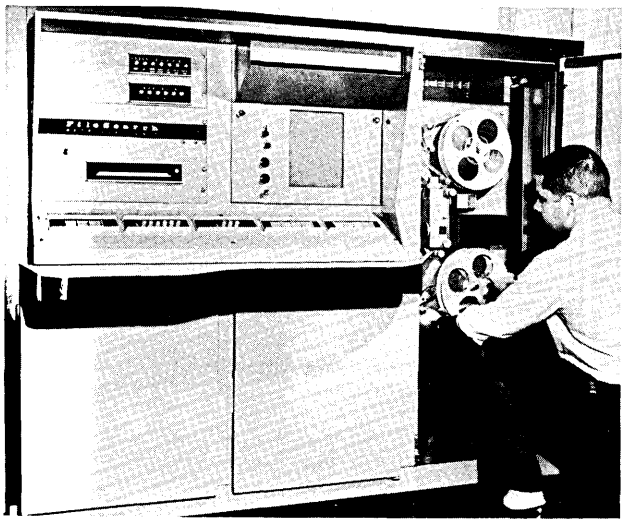
A new machine which can automatically search a 32,000-page file and present desired information in less time than it takes to drink a cup of coffee has been developed by this company.

Called FileSearch, the machine combines new advances in optical and electronic techniques, and is able to retrieve stored information from micro-filmed files at the fastest rate yet known.

The system stores 32,000 standard-sized magazine pages on a single reel of microfilm, and can accommodate over 1,600,000 pages of information, enough to crowd 40 four-drawer file cabinets, in a single file cabinet. When information is desired, the machine automatically searches the microfilm reels at the rate of 100 pages a second, making copies of the requested material.

With this machine, a researcher can locate in a few minutes all the data on a specific subject from an accumulation of thousands of pages of reports or documents. In an average working day he can obtain selected data from over three million pages on file.

The machine has been designed to meet the commercial need for an economical and practical system of information storage and retrieval. The price of the system, slightly over $100,000 is far below that of any other system capable of automatically performing such comprehensive information storage and retrieval.



This company has established production schedules for the machine. The first system has been sold to the Navy's Bureau of Ships, Washington, D.C., with delivery scheduled within the next month.

The system is basically composed of a recording unit and a retrieval unit. The recording unit photographs files of documents along with a description of each document's contents which is coded in the form of opaque spots. These are stored together on reels of microfilm.

The machine, from its request card input to its printed hard copy or film output, is integrated into a single console (71x55x50 inches) except for a recording camera and simple indexing machine. No associated units such as computers, card readers, etc., are required.

The retrieval unit searches for and finds the facts desired. It can check 6,400 standard pages (8½x11) on film per minute, and select out for viewing or printing, hard copy or film, any of those pages containing the type of information requested. Requests for information originally are fed into the machine by punched cards. The system can handle up to six requests simultaneously.

The facts requested from the masses of information stored on film may be projected on the machine's screen for viewing by the requestor. If permanent, usable records on paper are required, the machine then produces an immediate hard-copy print of the document.

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120 BUSINESSMEN PLAY MASS "MANAGEMENT GAME"

Radio Corporation of America
30 Rockefeller Plaza
New York 20, N.Y.

If an electronic computer can evaluate all the variables of a national election and accurately forecast the winner, then it should be able to predict sales trends for a business.

Operating on that premise, 120 midwest executives -- divided into 20 six-man teams -- competed with each other at the RCA Electronic Data Processing Center in Chicago on March 18 in "management game", to demonstrate their ability to manage a business with the aid of modern forecasting methods. The game was staged for the eighth annual Midwest Conference.

The game, designed especially for the conference by RCA, used the techniques developed in RCA's successful forecasting of the

1960 presidential election. It dealt with management problems such as: sales forecasting, inventory management and profit optimization.

All the competing teams were assigned to operate the same imaginary company over a period of three years with the goal of turning it into the most profitable concern in the industry. The company "executives" were required to base inventories on their sales needs during the three-month period beyond the date of the forecasts.

Forecasting techniques similar to those used by RCA in predicting the Kennedy victory were employed to provide market data to the management teams. Armed with this information, each team made its own decisions regarding future inventories -- the primary factor in measuring profit or loss.

Seven factors that might influence the imaginary company's sales were fed into the 501 computer, along with management's decisions. They were:

Current bank interest rates.
Federal spending.
Employment level.
Consumer spending on certain luxury items.
Income lost due to strikes.
Average farm spending.
Retail automobile sales.

Programming had been done in advance; the computer required only 40 seconds to provide each sales forecast. Programming of a sales forecasting method similar to the one used in the game for the average company requires six man-months of work; but once it is done it is permanent.

In contrast, a man working with a desk computer would require three months to arrive at the information needed for each forecast -- and virtually all of his work would have to be repeated for each period of operation.

In the "game" played Saturday, 30 minutes were allowed for each management operation covering one quarter of a year. The entire game lasted from 9 a.m. to 4 p.m., with an hour's break for lunch.

It was the final event of the conference, which was co-sponsored by the Chicago chapter of the American Statistical Association and the Chicago Association of Commerce and Industry.

HOW FINGER-TIP COUNTERS KEEP AHEAD OF HAT SALES

Veeder Root Inc.
70 Sargeant St.
Hartford 2, Conn.

Finger-tip counters have saved time and money by replacing laborious book and card systems for recording sales of boy's hats at the Pekett Headwear Company, New York.

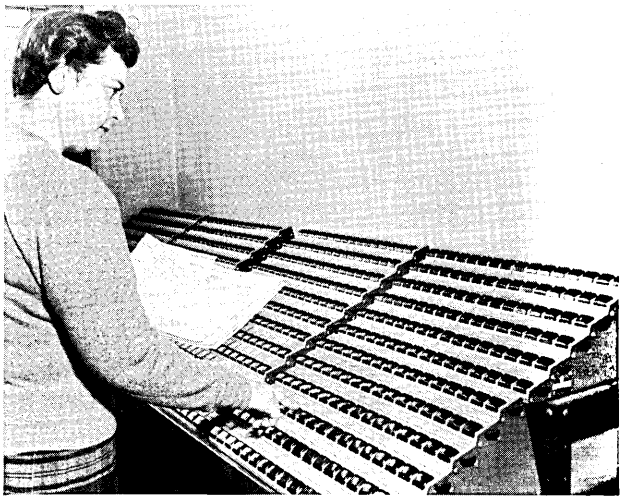
This 50-year-old firm was faced with the problem of keeping tabs on orders for some 300 different styles of hats, with the further complication of having each style available in five or six colors.

At first, a card system was devised, and this was then discarded in favor of standard books. Both of these methods, however, involved thumbing monotonously through lists, papers, and pages before a single notation could be made, causing both delays and occasional inaccuracies.

Finally, Sam Strauss, Office Manager, decided to try banks of multiple-unit reset counters, known as the "Vary-Tally" system. These are mechanical, four-digit counting devices which advance one unit at finger-tip pressure on a front lever.

Pekett's present Vary-Tally installation consists of 1152 individual counters, arranged in banks (see photo). There are 12 banks, each consisting of individual units mounted six tiers high and sixteen wide. Each counter is marked with the style and color of a hat, such as "Red 357," "Royal 1386," "Charcoal 237," "Willow 449," etc. These designations are changed approximately every six months when a new line is introduced.

When a purchase order has been filled, a secretary goes to the Vary-Tally counters and "presses off the sale" in accordance with the order. Each digit represents the sale of one-half dozen hats.



BANK GOES TO EDP FOR DEPOSIT, INSTALLMENT LOAN, CORPORATE TRUST, AND PERSONAL TRUST ACCOUNTING

Pittsburgh National Bank
P. O. Box 777
Pittsburgh 30, Pa.

Contracts have been signed by this bank with the General Electric Company for two complete GE 225 all-transistorized computer systems. The new equipment, the first of its type to be installed in the Eastern United States, will be used for deposit, installment loan, corporate trust and personal trust accounting.

The first of the electronic data processing systems will be installed in the summer of 1962. The second system will be installed by the end of that year. The total system will consist of two GE 225 computers, four document sorter-readers, ten magnetic tape units, a punched-card reader and punch, a punched-paper reader and three high-speed printers.

One of the GE 225 computers will be equipped with a magnetic tape system for storing and maintaining the account files for each of the applications. The second computer will perform all the data conversion operations. High-speed printers will convert information from the computers to printed form.

For customers' checking accounts, for instance, magnetically encoded checks and deposit tickets will be "read" by the data conversion computer at an effective rate of 120,000 documents per hour. A battery of four Document Sorters will then arrange the checks in proper order for giving information to the computer, each fine-sorting at the rate of 14,000 checks an hour.

The file processing computer will then digest the information. For the bank's demand deposit accounts the computer will calculate changes and post accounts at the rate of 1,500 a minute. To post checks, deposits, rejects, overdrafts, stop payments, watch for holds, and perform other steps, the computer will make 16,000 calculations a second.

Finally, each high-speed printer will be able to turn out 1,500 complete customer statements per hour.

When the first system goes into operation, it will be used to process all checks and deposits for the bank's 60,000 deluxe checking accounts, which represent about 30,000 items a day. In addition, it will handle the transactions for approximately 105,000 time-plan consumer-loan accounts. Upon completion of the second installation, the combined system will handle all deposit and check processing for the bank's 170,000 checking accounts, representing a total volume of approximately 190,000 items per day. Corporate Trust, Personal Trust and Transit Operations will then be converted to the new electronic data processing system.

The system was designed by the bank's Automation Development Division and a team of specialists on computer systems from the management consulting firm of Booz, Allen & Hamilton.

READING AND WRITING ON MAGNETIC TAPE AT 1200 BITS PER INCH

Potter Instrument Co.
Sunnyside Blvd.
Plainview, N.Y.

A new standard high-density, high-precision tape handler system has been developed by this company. The unit is named the PHD-1200 High Density System and includes the 906II High Density Tape Handler used in the Bendix G-20 System.

This high density magnetic digital tape recording system offers the ability to read and write tapes at packing densities of 1200 bits per inch with extreme reliability. Transient error rates are fewer than 1 bit in 10^8; permanent error rates are less than 1 bit in 10^{10}. More than 20,000 passes of the same tape can be made without losing information or increasing the transient dropout rate.

Dropouts are fewer than 1 in 10 billion at 1200 bits per inch. More than 20,000 passes of the tape can be made without losing information or significantly increasing the reading error rate.

The tape transport operates at a tape speed of 100 inches per second with a packing density of 1200 bits per inch, and a rewind speed of 200 inches per second. The one-inch wide tape contains eight information channels, one block marker channel, and one parity channel.

MODEL OF COMPUTER-CONTROLLED "TV STATION OF THE FUTURE" SHOWN

Radio Corporation of America
30 Rockefeller Plaza
New York 20, N.Y.

A fully-automated television station, with both broadcast programming and station business procedures under complete control of a computer system, has been developed for the broadcasting industry. It was exhibited in May be RCA at the meeting of the National Association of Broadcasters in Washington, D.C.

This equipment makes possible television stations entirely controlled by an integrated electronic system.

C. H. Colledge, Division Vice President and General Manager, RCA Broadcast and Television Equipment Division, said the RCA concept represented "the ultimate in television station automation -- a goal toward which the industry is moving rapidly."

"A business as complex as a television station, with its technical side, its sales operation, billing, news, traffic and many other aspects, can realize substantial efficiencies from automated control," Mr. Colledge said.

"We visualize the broadcaster approaching full automation not all at once but in a three-step process: first, modernization of his technical equipment; next, simplification of operational controls; and finally, the integration of all station operations."

With the television industry's rapid growth function upon function has been added to station broadcast operations, greatly complicating the control problem and creating a confusing array of buttons to push and knobs to turn.

Equipment improvements have been introduced to speed the march toward automatic control, with its benefits of greater efficiency and the reduction of the chance of human error. In station modernization programs, the use of such equipment is a first stride toward automation.

Some of the most recent improvements in this direction include a continuous loop for film projectors, semi-automatic live cameras, random access tape with automatic cue, and an "automatic announcer".

The "automatic announcer" is a combination of RCA's RT-7 cartridge tape recorder and its TP-7 slide projector, providing a complete sequence of slides synchronized with a recorded announcement. The unit may be operated by push button or by a signal cue from other equipment.

Total automation envisions the complete integration of the broadcasting and technical functions with those of the business office, using electronic data processing both for on-the-air switching and for such activities as time availabilities, adjacencies, schedules and billing, among others.

3rd INTERNATIONAL CONGRESS ON CYBERNETICS, NAMUR, BELGIUM, SEPT. 11-15, 1961

Secretariat
Association Internationale de Cybernétique
13, rue Basse-Marcelle
Namur, Belgium

The 3rd International Congress on Cybernetics, called by the International Association for Cybernetics, will be held at Namur, Belgium, September 11 to 15, 1961.

Five main themes will be considered:

1) The bases and methods of cybernetics
2) Semantic machines
3) Automation: technical aspects
4) Automation: economic and social aspects
5) Cybernetics and life

A general opening lecture will be given by Mr. Georges Villiers, President of the French National Employers Council.

General lectures followed by discussions will be given also as follows:

"Cybernetics and Biology" by Dr. Henri Laborit, principal physician of the French National Navy, Director of the Eutonological Laboratory of the Physio-Biological Research Section, Paris, Sept. 12.

"Cybernetics of Evolution and Self-Organization" by Mr. Gordon A. Pask, System Research Ltd., Richmond, Sept. 13.

"Variability and Specificity" by Mr. François Bonsack, Professor at the Federal Polytechnic High School, Zürich, Switzerland, Sept. 14.

For further information, please write to the Secretariat.

DETERMINATION OF WEATHER VARIABLES USING NEW DEVICES AND A COMPUTER

Armour Research Foundation
Illinois Institute of Technology
35 West 33rd St.
Chicago 16, Ill.

Accurate determination of weather variables in areas up to 25 miles away is now possible without venturing into the area under study, according to scientists at this foundation.

A study indicates that it is possible to determine the following weather variables at a remote point: temperature; relative humidity; air pressure; wind direction; wind speed. The proposed system also can determine these weather factors at heights up to 5,000 feet and, using an accompanying computer, provide a meteorological profile.

Here is how the system would work: two methods would be used for measuring temperature by passive means: (a) a microwave radiometer to measure the emission from oxygen in the 60 KMC region of the microwave spectrum; (b) a radiometer to measure the emission from carbon dioxide in the 4.3 micron region of the infrared spectrum. One means is primarily a radar instrument, the other an optical instrument.

These radiometer readings would be converted to temperature-height profiles, and complement one another providing fuller information.

The technique for measuring relative humidity is similar to the technique for measuring temperature; the main differences are in frequencies of the radiometers.

Wind information would be obtained by detecting acoustic disturbances along a vertical line by an array of ground stations. In this method, rocket grenades would be used to produce the acoustic disturbances. Appropriately placed stations would detect the time and angle of arrival of each sound burst.

This data, coupled with information of the position of the explosions, atmospheric temperature, relative humidity, and density allow the wind structure to be deduced.

Using knowledge of air pressure at the ground, and the temperature and relative humidity data from the radiometers, the pressure-height profile is easily constructed by a computer.

The digital computer reduces the large quantity of measurement data to condensed answers.

The proposed system would help fill the present gap in the measurement of micrometeorological variables.

TRANSISTORIZED DESK CALCULATING MACHINE

Electrosolids Corp.
13745 Saticoy St.
Panorama City, Calif.

A fully transistorized solid-state desk calculator with instant response and no moving parts is being developed by this company. Called "TAC" (Transistorized Automatic Calculator), it is designed to compete in price with conventional mechanical machines. Higher reliability is expected from the fact that electrons can transfer information instead of gears and cams. Since electrons travel at the speed of light, the new calculator performs addition, subtraction, multiplication, and division almost instantaneously while mechanical machines require several seconds to work out some of their functions.

The sales in the desk calculator business today is estimated at $60,000,000 to $75,000,000 per year. However, no machines currently marketed are transistorized. The new desk computer is expected to enter the market late in 1961.

Comparable ten-column calculators cost as high as $695. The new computer is expected to sell for $495.

Computron Corp., a subsidiary of Electrosolids, will manufacture the new computers. The subsidiary will be under the direction of Dr. Stanley Frankel.

A former consultant of General Electric and Packard-Bell, Dr. Frankel has been active in the field of electronic computers since 1947. He formerly taught at California Institute of Technology.

HIGH SPEED TESTING OF ELECTRONIC COMPONENTS BY "SATE"

General Precision, Inc.
Librascope Div.
Glendale 1, Calif.

A new system for high speed testing of electronic components has been introduced by this company.

The system, called SATE for Semi-Automatic Test Equipment, is designed to replace tedious manual testing now necessary to check component reliability.

The system will evaluate components for combinations of ten parameters and accept or reject each at a machine rate of 1800 components per hour.

One of the first systems is in use testing transistors, and is providing a saving of 96% over the cost of performing the equivalent manual tests.

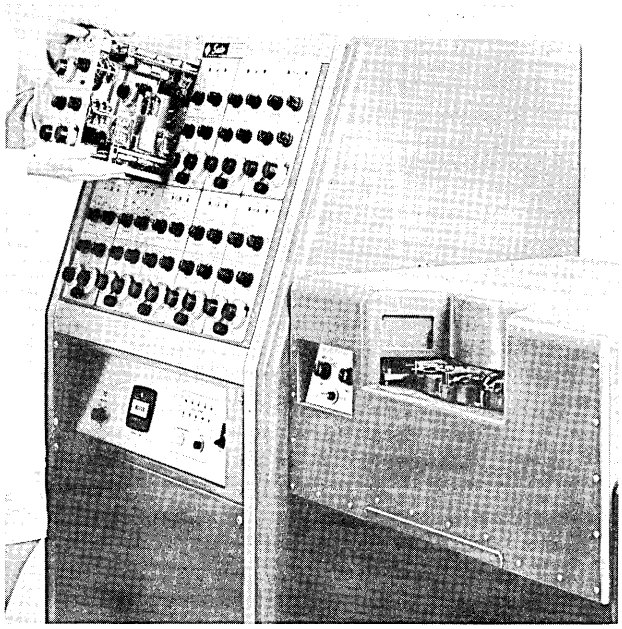
Each module in the electronic console controls one of ten test stations in the mechanical handling console, shown in the picture at the right. The modules contain binary-type logic circuitry for making go/no-go decisions.

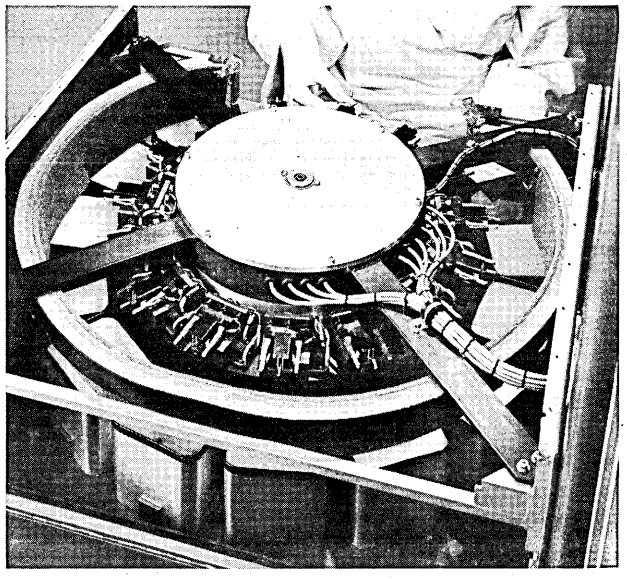
Each module is provided with controls for setting test conditions and establishing parameter limits.

An operator inserts components in a revolving table in the mechanical handling console. The table carries the component to each of the ten test stations. At each station the component is tested for a different parameter and is automatically rejected if it fails to meet predetermined limits.

Plug-in modular circuitry incorporated in the design of SATE permits flexibility in application for immediate uses and adaptation to changes in the state-of-the-art in the electronic component industry.

SATE automatically performs continuing self-checking during operation to insure testing accuracy.





You can solve your computer problems quickly and economically by using our 32K-word storage IBM 704. Whether you need long or short runs, they can be readily scheduled on our machine at the same attractive rate for every shift—$275 per hour, including all peripheral equipment and operators ■ Bring your program to us and work in our Client's Room between runs—or mail us your program with instructions for running it and we will mail back the printout within 24 hours—or simply leave your entire problem in the hands of our capable mathematical analysts and programmers whose skills can be relied upon ■ If you need pipe stress, structural stress, flow analysis, or curve fitting, one of our general programs might well be just what you are looking for ■ To take advantage of our prompt, efficient computer services, write, wire or call us collect, Hilltop 5-4321, extension 1449. ELECTRIC BOAT A DIVISION OF GENERAL DYNAMICS GIIIIIIID

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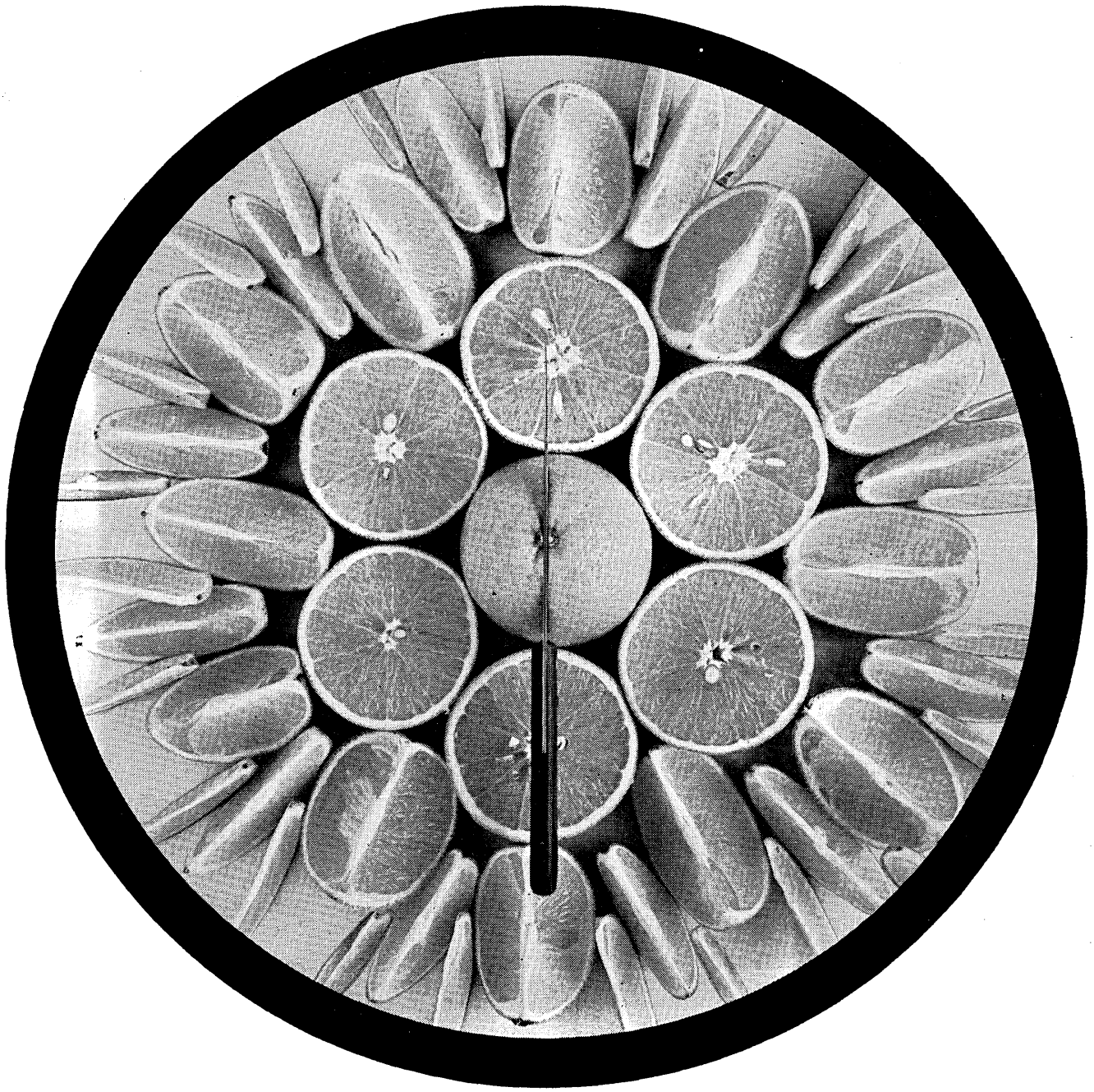

THE COMING TECHNOLOGICAL SOCIETY

(Continued from page 16)

will also routinely introduce his data on a patient into a network of "consultative wisdom." The patient's entire history, the results of all tests, the symptoms and complaints, and a statement of the family background of inherited tendencies—all this will be efficiently introduced into the medical intellectronics system. The system will quickly react to give the doctor key portions of the equivalent of many consultations with other physicians. It will call out questions and possibilities our physician may not have considered. It will give statistical probabilities (it will have the amassed data to do so) of the relative effectiveness of various treatments—with numerous variations and warnings to account for corollary possibilities and complications. All of this will be automatically turned up by the machine, triggered by the specific, detailed data that the physician introduced about his patient.

Notice that with diseases nationally monitored the statistical approach to medical practice will take on an entirely new stature. Cause and effect relationships will be studied on a large and rapid scale, tying ailment to treatment. And again, the system will raise the intellectual effort of the users—the physicians.

Missile Design

The engineering field has already been revolutionized by intellectronics. The intercontinental ballistic missile would today be many years away if we had not extended the brains of the designer by electronics. Thousands of flights would have been needed in a clumsy trial-and-error approach. Instead, mere dozens of actual flights have been sufficient to finalize the engineering and prove out the design. The thousands of flights took place in the simulation laboratories, and the selection of the right combination of design parameters out of the myriad of possibilities—too huge a task for human comparison and sorting alone—was made by a man-machine partnership.

Library Organization

We observe that one of the things we can do with electronics is to create a library of information that is both mammoth and yet almost instantly accessible. But the memory extension is far from the total effect. The properly designed artificial intelligence works on the library's information. It has built into it a set of logical rules chosen by the human partner. With this logic, and with the information in its memory, the machine can handle the low intellectual tasks of the first sorting, the categorizing, the comparing, the selecting, and the presenting. These tasks, done well, require typically that tremendous volumes of data be processed quickly. The machine member of the partnership does this high-quantity, high-rate part of the intellectual job, allowing the higher intellect of the human partner to concentrate on the more subtle, less predictable, less routine aspects—the conclusion-drawing, decision-making, judgment phases of the intellectual task.

Money and Banking

Take money and banking, and the whole process of keeping track of who owns what, where it is, and who owes whom. How absurd that for this kind of work we still have millions of people engaged all day in putting little marks on pieces of paper, reading them off, entering them—without much need for deliberation in the process. Most of this is as unsuitable for the human intellect as pulling huge stones to build the pyramids was for human muscles. Some day currency and coins will be for the rural areas. Even checks and most other forms of today's original records may become extinct. If you buy a necktie or a house, your thumb before an electronic scanner will identify you, and the network will debit your account and credit the seller. The system will automatically do the routine accounting and will call out any problems in the transaction. (Of course, occasionally, a transistor burning out in Kansas City may accidentally wipe out someone's fortune in Philadelphia. There will continue to be some dangers and risks in life in the period ahead, although many will likely be new ones.)

Reservations

How about the making of reservations—airlines, hotels, and the like—and the waste in human intellectual capacity which is entailed in this increasingly important aspect of keeping the operations of the world going? In the future, we should be able to step up to a telephone-like device and, after consulting something much like a telephone book, dial a reservation request. The instrument will respond by giving a "no" answer, or will display alternatives that are available, or indicate an acceptance of our request. It will print out the ticket, automatically charging our account, avoiding errors, confusion, disappointment, and poor use of available accommodations.

So far as technology is concerned, there is nothing about the library or the money or banking or reservation problems that requires any new invention in pure science for the application of intellectronics. It does take a great deal of engineering to achieve any one of the specific advances we might cite, and we apparently can do without any given one today. However, in each instance, we see that the increased volumes and rates, and, again, the interactions and complexities of our growing information-controlled world, are pressing for new systems for handling these intellectual processes.

Control of Moving Things

It is hard to find a better example of the urgent need for man-machine, intellectronics partnerships to handle thinking tasks than the control of things moving in the sky and even on the ground. It is clear that a human brain unaided—whether that of a pilot, an airport controller, or a Los Angeles automobile driver—cannot integrate all of the changing, dynamic, split-second facts to make decisions leading to the smoothest, safest, maximum use of a traffic artery. Intellectronics measurements are needed instantaneously on the nature, quantity, rate of change, spatial spread, and interrelation of traffic. Automatic predictions then need to be made as to consequences, and directions issued to control the flow. Not only will the handling of airplanes and the role of the pilot be drastically changed with time, but it is not completely ridiculous to imagine automobiles of the future which go on electronic control as they enter a crowded, speedy freeway—the driver limited to push-buttoning his chosen exit.

Management

The average business can shift between profit and loss positions easily, by just raising or degrading the information available for decision-making by management. We are working on management control systems in which information as to what is happening will be electronically compared with the plan. Deviations will automatically produce directives for changes in operation in accordance with "stored" logic set in by management to cover many possible situations; or the system will call out warnings, when the unexpected happens, to the higher intellect of the human supervisors who are kept free for the unpredictable, more difficult, nonrecurring situations. This is the same as having additional and more knowledgeable managers, and it also helps toward the goal of putting management on a scientific basis.

Language

Clearly, most of the physical operations of the world (such as production, transportation, communication) are candidates for passing under intellectronics systems control. It is also significant to note that many of these operations involve world-wide integration and interconnection. In the coming years, many millions of human beings—and their extensions in the form of electronic devices with electronically coded information—will be increasingly in direct contact with each other across the world's language barriers. No wonder one of the most interesting intellectronics areas in which we are engaged is the automatic translation of natural languages. Again, the machine member of the team provides the crude first cut. It also identifies double meaning possibilities and weighs the alternatives based on what has preceded. It assists and sets up for the more brainy human partner, and the combination turns out a far better performance than either alone.

The concept of what language is will probably change drastically in the years ahead. The machine partners in the universal electronic systems of the future will want the facts and the rules in the most efficient form possible. They will create pressure for a universal, purely informational, completely logical and consistent kind of language. Natural languages, with their origins in earlier nontechnical ages, do not satisfy all these conditions. The technological, intellectronics period of the future may force on the world a new kind of language reform.

Education of Human Brains

The most truly intellectual activity of all must be the education of the human brain. Now, we are approaching a crisis in education because, while the needs of the more complicated, more populous world are increasing rapidly, our ability to place human resources behind the educational system is apparently decreasing. But an intellectronics system could make a tenfold change in the effectiveness of education. The human educator can have tools analogous to the physician's X-ray machines and electrocardiographs. The routine material can be machine-presented, leaving the more difficult concepts for the higher intellect of the human educator. Programmed machines can stimulate thinking of the student. An electronic presenter can speed up or slow down, add more explanations, skip steps, even as it makes the presentation—all as a result of continually noting the student's push-button responses to questions and then automatically changing the material or its pace to correspond to the student's apparent comprehension.

An intellectronics system can be built to remember the progress of any number of students, even in the millions if that is desired. It can compare their tested learning with the plan. It can measure and report deviations. Yet, that same system can immediately recognize an individual student and give him an accelerated or other special presentation or test—all by a virtually instantaneous scan of his record and by following rules that have been set in by the wiser human educator.

When the educator discusses a student's progress, he can have before him broad records of plans and performance for that student, as well as complete statistics on much of the whole educational process.

Such a future educational system would involve new large industries employing experts in the subjects to be taught, in the design of programs, and in the design and production of the devices and the systems. There will be new professional groups within an augmented educational profession to provide for statistical study and planning, diagnosis, and generally for the matching of the synthetic intelligence of the machine with the human brain to achieve the fullest utilization of both in an educational system really suited to the coming technological age. The human educator will be able to rise to a higher level of intellectual endeavor, relieved of much of the volume of routine intellectual work so much a part of the teaching profession today.

Military Command

In assuring the defense of our nation, it is some years now since the first priority was to create the force, exemplified by the bomb, to provide the necessary military might for defense purposes. We now are already passing through the next phase, where we are providing the capability of delivering the force wherever it is needed on any part of the earth's surface in a very short time. The coming, urgent, highest priority area in the application of technology to the military is in the intellectual aspect of the military problem—in control and command, observation and communications. In a world in which one nation can inflict decisive damage on another in a few minutes, even though they are separated by half the earth, sound military action requires knowing what is going on everywhere. And this tremendous amount of diverse, confusing, and continually shifting warnings and other information must be put together into sound conclusions ready for major all-out decisions, with minor ones made automatically and rapidly in accordance with some prearranged plan. A man-machine, intellectronics partnership is the only answer in sight to this problem.

Brain Power

In the world ahead, brain power is going to be the secret of success—the source of stature, of adjustment, of security—whether for nations or for the world as a whole. But brain power in the future will clearly be reckoned as the sum of natural human intelligence plus electronic intelligence. And that nation will be

most influential and secure in the future that has the greatest total of developed brain power. This means the maximum development of its natural human intelligence and the greatest exploitation of science and technology to produce synthetic intelligence. There is a snowballing effect here. The greater the synthetic intelligence, the more it will help to develop and increase the usefulness of natural intelligence; the greater the human intelligence, the more certain we will be to have the highest state of development of the artificial intellectronics systems and the better will be the match.

So far, we have seen some major technological possibilities of the society of the future in relation to certain specific functions. It is time now to widen our view and look at what some of the consequences might be in some of the broader aspects of life—freedom and democracy, international cooperation, our understanding of the universe, even art and music. Perhaps just to mention these words suggests a presumptuous departure on my part from the narrow and more proper goal I set for myself as a technologist at the beginning. Yet, the next remarks are not really inconsistent with the desire to keep my comments to my special field. It is simply that it may be of aid to those who are skilled in these other fields if some points are offered by the technologist for their consideration.

Not a Regimented Future

To start with, we have the problem that as a result of the preceding description some may take away with them one very wrong impression; namely, that the world of the future will be an automated, robot-like, regimented world, with man—even though the controller and originator—no more than an anonymous cog. The world will be one in which freedom, democracy, the creative spirit—all such concepts—will be pushed into the background as a mad complex of men, machines, communications, and vehicles interacts to produce, move, and keep track of everything that makes up the material aspects of life.

Greater Democracy

I want to stress that this is not only an unnecessary consequence, but that it is an unlikely one. Let me use another example, one which is certainly an exaggeration to prove a point, but which, as with all of the previous examples, has a technologically valid basis. Suppose we want to achieve the greatest possible participation by the people of the world in determining plans and policies. We want greater democracy. We want to insure that we are all occupied with thinking about the issues that control our lives. Now, imagine that the deliberative bodies, the congresses, of the world are exposed to every home continuously by a special television-like unit. Suppose also that it is the practice in the technological society of the future for a large fraction of the issues to come up for a vote, not just by the congress, but by the people. For emphasis, let us imagine a somewhat extreme situation, doubtlessly beyond either practicality or desirability, in which it is the custom for the registered voters several times a day to identify themselves to the home voting machine (with their scanned thumbprints) and to put in a "yes" or a "no," or a vote for "A," "B," or "C." The national system then automatically registers, checks, adds up, determines, and immediately announces to the nation the majority viewpoint. Clearly, the highly technological society of the future can be one in which communications are so widespread and efficient that frequent voting is easy, participation is virtually guaranteed, interest is heightened, and apathy and ignorance are virtually eliminated.

In short, to those who are skilled in political science, it is worth suggesting that one of the characteristics of the technological society ahead of us is that we can have as much participation by the average citizen in the affairs of the world as we choose to have, within the limits of his interest in the issues. Technology makes possible, obviously, more than any practical arrangement of society will permit us to use. After all, we could not operate stably if too many voters oscillated from day to day in their choice of chief executive, something which technology makes possible but which is hardly acceptable as a political reality.

International Cooperation

By the year 2000, the pressures must certainly be enormous for international cooperation on a scale that we cannot hope to detail today, and those who study world social forces will want to give new emphasis to the technological aspects. We have previously pointed out the pressure that the machine partner will create for uniform language, at least language as it applies to information transmittal to keep the world's operations going. As another instance, we have already become reconciled to the increasing traffic in the skies and in space, both in numbers and in speed, and to the need for world-wide navigation and traffic control, if the situation is to be an orderly one rather than a nerve-racking one.

Weather Control

As a future example, we can hardly imagine a world-wide weather control system, unless indeed it is one that involves world cooperation. Picture a system involving simultaneous measurements at many places on the earth's surface, in the atmosphere, and out in space, recording all of the important quantities (such as pressure, temperature, humidity, winds, radiation) required to predict weather. All of this information is brought to central points, where it is computer-processed, with the aid of mathematical equations based on past weather conditions, to provide up-to-date forecasts. These forecasts are then fed into another part of the intellectronics system where decisions are made, some automatically and some by the human partner, on what to do about the weather. Energy and matter are then released at various points on the surface or in the sky in order to alter the weather to something that will be different from and better than that which the system tells us would otherwise occur.

But all weather interacts. Increasing the rainfall in the Sahara Desert, for example, may adversely affect the weather of Canada or Mexico. Clearly, we need not only technical cooperation, but cooperation by governments to arrange for common goals and rules of operation.

Communications

The situation is not unlike the need for having an integrated telephone system. We long ago saw in the

United States that we could not hope to develop a practical large-scale telephone system if we had different telephone companies competing in the same area. The average business or home in such communities would have had to have a different telephone for each system. The answer was to provide for integrated, government-monitored common systems. Indeed, communications is a continuing example into the future. The very extension of world-wide telephone service by way of space satellites brings into play all of the problems of "arrangement-making"—the job of government-chairmanning to decide what shall be done, who shall do it, and who shall run it when it has been brought into existence. And again, international agreements are involved.

We have already noted that in the intellectual professions an electronically accessible library of information can step up greatly the quality and speed of effort. Here too, intellectronics presses for wider and wider interconnection, so that, finally, what may be desired are means for interconnecting the separate libraries of the individual countries, and even perhaps for all countries to be able to tie into a "United Nations" repository of facts, statistics, and records.

Progress Towards More Accurate Concepts

With intellectronics bringing rapid, yet mammoth, quantities of statistical information to bear on the operations of the world, the result is that those operations become more scientific. They are less speculative. It becomes possible to be more exact and quantitative about everything that is under consideration. Moreover, automatic processing requires that we pinpoint the logic behind our actions. The impartial, purely logical analysis that must precede the use of intellectronics systems should therefore lend support in many cases to those who are working toward new and more accurate concepts. Whether the field is medicine or law or engineering or, indeed, government itself, intuitive feelings can be replaced by facts and analysis. Moreover, the systems to some extent are self-criticizing; inconsistencies in operations may be disclosed by the very systems that attempt to insure consistency. They automatically may show us where we must make changes in our ways of doing things.

The Year 2000

Let us grow bolder in a final view of the relationship between the new technology and the social forces of the future. What will be our feelings in the year 2000 about the goals of mankind, about what constitutes happiness and security, about the definition of freedom? On one hand, man will be faced with the evidence all about him of an infinitely intricate, busy, fast world consisting of a multiple-interconnected web of people, vehicles, machines, and communications. Always there will be the fear of man's being lost as a free soul. Great concern will exist about retaining freedom and flexibility, and minimizing tight rules and stiff controls.

But, on the other hand, man will become conscious of the enormity of the universe. We shall be talking daily about distances between planets and between stars. The words "billions of years" will appear in common conversations. We shall be talking about traveling at speeds near the velocity of light, and, in detail, about the nature of life on other planets. We may indeed be engaged in intensive work to decipher intelligent transmissions from outer space that we have received.

In short, in some ways our life will seem to have the tendency of closing in on us, but at the same time other aspects of life will have opened bigger doors than man ever before looked through. Perhaps to depict the infinite detail of our existence on the one hand and the enormity of the unconquered vistas on the other, music and art will ask for more dimensions. We shall commence, for instance, to fill in the musical tones between the "half steps." Our ears will become accustomed to increasingly detailed differences. The composer will find them necessary, the listener excitingly satisfying. A typical painting or symphony may involve almost subvisual and subaural intricacies of detail, and yet at the same time these art forms must have a new gross magnitude, boldness, a new mystery, taking in the whole universe.

We face endless involvement and crowded containment, yet we shall have infinite scope in space and time. What a paradox for the philosophers, the artists, and the sociologists to work on at the turn of the century.

Having sketched some of the technological highlights of the world toward which we are in transition, and then having suggested some of the broader, nontechnical aspects which technology will influence, we are still left after this brief exploration with many more fascinating, important, and even fundamental questions: How shall we enhance, even retain, creativity in a world which seems to require so much coordination? How will man's incentive for accomplishment and service to his fellowmen be caused, hopefully, to flourish? How do we insure freedom to do as we please when it does not interfere with the rights of others? How do we maintain freedom of thought and true unfettered thinking in an environment of highly integrated planning?

Really, all of these questions are part of bigger questions: Will the transition to the new, highly technological society be orderly or chaotic? Will sociological development be accelerated to catch up with scientific development?

Accelerating Social Progress

The real bottleneck to progress, to a safe, orderly, and happy transition to the coming technological age, lies in the severe disparity between scientific and sociological advance. Having discussed technology, with emphasis on the future extension of man's intellect, we should ask: Will intellectronics aid in removing the imbalance? Will technology, properly used, make possible a correction of the very imbalance which causes technology to be in the lead? I believe that the challenging intellectual task of accelerating social progress is for the human mind and not his less intellectual electronic partner. But perhaps there is a hope. If the machines do more of the routine, everyday, intellectual tasks and insure the success of the material operations of the world, man's work will be elevated to the higher mental domains. He will have the time, the intellectual stature, and hence the inclination to solve the world's social problems. We must believe he has the capability.

READERS' AND EDITOR'S FORUM

(Continued from Page 6)

is to prepare to try to survive and win a war that will certainly come, sooner or later. Besides, it is better to die than to live under *some* conditions.

II.

From the Editor

We value readers' discussion and argument on the controversial subject of computers and arms control. A great many ideas need thoughtful consideration before a rational consensus develops among the people of a country.

One reader says "Only by the action A can we break the condition B." Logically such a statement is open to question, because it is very hard to show that there exists only one way (A) and no others for accomplishing something (breaking up B).

Another reader says "All C's in history have resulted in D. Therefore we can expect D, and we should adjust to that." This argument also is to be distrusted, because in history some conditions D stop. For example, human slavery has stopped, which was not true when the Constitution of the United States was written.

One of the main problems of computer people is living up to their social responsibilities as computer people—actions to help avoid the destruction of millions and millions of people from the use of nuclear weapons guided by computing mechanisms.

RESTLESS GIANT

Walter Brandenberg
Lake Mahopoe, N. Y.

Thunk, Thunk, Thunk,
Steel jaws clattering,
Gulping cards by the hundreds,
Digesting every perforated fact.
Keep that hopper full,
Not a minute's rest.

Swish, Swish, Swish,
Like an angry Python,
Darting in amongst the whirling disks,
Striking with deadly precision.
A miss would be tragic,
Not a second's rest.

Whirr, Whirr, Whirr,
Load that tape,
Characters by the thousands,
Reels twitching nervously,
Tape quivering with tension,
Not a millisecond's rest.

Flip, Flip, Flip,
Cores switching row on row,
Hysterically pursuing the elusive flux.
Memories from which to pick and choose,
Following tortuous windings to a random bit.
Not a microsecond's rest.

Think, Think, Think,
Bits, Bytes, Characters, and Words
Records variable and fixed.
Serial, Parallel, Random data pouring in and out,
Calculations by the millions,
Not a millimicrosecond's rest.

Hum, Hum, Hum,
Rolling on with high-pitched whine,
Spewing out broadsides of magnetic moment,
Heads gliding along on flying disks,
Minute ripples and sinus currents,
Not a microsecond's rest.

Clatter, Clatter, Clatter,
Cascades of rippling paper,
Rows of hieroglyphics,
A language called computerese,
Keep that paper flowing,
Not a millisecond's rest.

Kerchunk, Kerchunk, Kerchunk,
Angry teeth biting a new pattern,
Checking it when all is done,
Spitting out chips that have no further meaning,
Tiny windows shedding light on the unknown,
Not a second's rest.

Watching, Watching, Watching,
Anxious eyes their vigil keep,
Time is such a trifle-deci, milli, micro,
But the cost is astronomic-centi, kilo, mega.
Pushing buttons, throwing switches,
Not a minute's rest.

Walter Brandenberg

CALENDAR OF COMING EVENTS

July 13-14, 1961: Conference on Data Acquisition and Processing in Biology and Medicine, University of Rochester, Rochester 20, N. Y.; contact Kurt Enslein, Dir. of Research, Brooks Research, Inc., 399 W. Commercial St., P. O. Box 271, E. Rochester, N. Y.

July 16-21, 1961: 4th International Conf. on Medical Electronics & 14th Conf. on Elec. Tech. in Med. & Bio., Waldorf Astoria Hotel, New York, N. Y.; contact Dr. Herman P. Schwan, Univ. of Pa., Moore School of Electrical Eng., Philadelphia 4, Pa.

July 21-22, 1961: 1961 Northwest Computing Association Annual Conference, Univ. of British Columbia, Vancouver, British Columbia, Can.; contact Conference Information, Northwest Computing Assoc., Box 836, Seahurst, Wash.

Aug. 22-25, 1961: WESCON, Cow Palace, San Francisco, Calif.; contact E. W. Herold, c/o WESCON, No. Calif. Office, 701 Welch Rd., Palo Alto, Calif.

Sept. 4-9, 1961: Third International Conference on Analog Computation, organized by the International Association for Analog Computation and the Yugoslav National Committee for Electronics, Telecommunications, Automation and Nuclear Engineering, Belgrade, Yugoslavia.

Sept. 5-8, 1961: The First International Conference on Machine Translation of Languages and Applied Language Analysis, National Physical Laboratory, Teddington,

Middlesex, England; contact Mr. John McDaniel, National Physical Lab., Teddington, Middlesex, England, TEDdington Lock 3222, Ext. 138.

Sept. 5-8, 1961: 16th National Conference of the Association for Computing Machinery and 1st International Data Processing Exhibit, Statler-Hilton Hotel, Los Angeles, Calif.; contact Benjamin F. Handy, Jr., Gen. Chairman, Litton Systems, 5500 Canoga Ave., Woodland Hills, Calif.; E. Floyd Sherman, Exhibits Chairman, Control Data Corp., 8421 Wilshire Blvd., Beverly Hills, Calif.

Sept. 6-8, 1961: National Symposium on Space Elec. & Telemetry, Albuquerque, N. M.; contact Dr. B. L. Basore, 2405 Parsifal, N.E., Albuquerque, N. M.

Sept. 6-8, 1961: 1961 Annual Meeting of the Association for Computing Machinery, Statler Hotel, Los Angeles, Calif., contact Benjamin Handy, Chairman, Local Arrangements Committee, Litton Industries, Inc., 11728 W. Olympic Blvd., W. Los Angeles, Calif.

Sept. 11-15, 1961: The Third International Congress on Cybernetics, Namur, Belgium; contact Secretariat of The International Association for Cybernetics, 13, rue Basse Marcelle, Namur, Belgium.

Sept. 11-15, 1961: ISA Fall Instrument-Automation Conference & Exhibit and ISA's 16th Annual Meeting, The Biltmore Hotel and Memorial Sports Arena, Los Angeles, Calif.; contact William H. Kushnick, Exec. Dir., ISA, 313 6th Ave., Pittsburgh 22, Pa.

Sept. 24-26, 1961: International Congress of Automation, Turin Polytechnic, Turin, Italy; contact Secretary, International Congress of Automation, 1, Piazza Belgioioso, Milan, Italy.

Oct. 10-13, 1961: USE Meeting, Warwick Hotel, Philadelphia, Pa.; contact J. W. Nickitas, Sec'y, USE, Remington Rand Univac, 315 Park Ave. So., New York 10, N. Y.

Oct. 11-13, 1961: Conference on Application of Digital Computers to Automated Instruction (sponsored by System Development Corp. and the Office of Naval Research), Dept. of Interior Auditorium, C St., between 18th and 19th Sts. N.W., Washington, D. C.; contact Washington Liaison Office, System Development Corp., 1725 Eye St. N.W., Washington 6, D. C.

Oct. 12-13, 1961: The Univac Users Association Fall Conference, Warwick Hotel, Philadelphia, Pa.; contact Walter Edmiston, Sec'y, Univac Users Association, Philadelphia Naval Shipyard, Philadelphia 12, Pa.

Oct. 25-26, 1961: 1961 Computer Applications Symposium, Morrison Hotel, Chicago, Ill.; contact Benjamin Mittman, conf. program chmn., Armour Research Foundation, 10 W. 35 St., Chicago 16, Ill.

Oct. 30-Nov. 3, 1961: 8th Institute on Electronics in Management, The American Univ., 1901 F St., N.W., Washington 6, D. C.; contact Dr. Lowell H. Hattery, Dir., 8th Institute on Electronics in Management, The American Univ., 1901 F St. N.W., Washington 6, D. C.

Dec. 12-14, 1961: Eastern Joint Computer Conference, Sheraton Park Hotel, Washington, D. C.; contact Jack Moshman, C-E-I-R, Inc., 1200 Jefferson Davis Highway, Arlington 2, Va.

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Who's Who in the Computer Field

(Supplement)

A full entry in the "Who's Who in the Computer Field" consists of: name / title, organization, address / interests (the capital letters of the abbreviations are the initial letters of Applications, Business, Construction, Design, Electronics, Logic, Mathematics, Programming, Sales) / year of birth, college or last school (background), year of entering the computer field, occupation / other information such as distinctions, publications, etc. An absence of information is indicated by - (hyphen). Other abbreviations are used which may be easily guessed like those in the telephone book.

Every now and then a group of completed Who's Who entry forms come in to us together from a single organization. This is a considerable help to a compiler, and we thank the people who are kind enough to arrange this. In such cases, the organization and the address are represented by . . . (three dots).

Following are several sets of such Who's Who entries.

The Babcock and Wilcox Co. Research Center, Alliance, Ohio

Ralston, Edward L / Aplns Repr, . . . / A / '20, Columbia Univ. '55,—

Tamanaha, Hideko Miss / Prgmr-Oper, . . . / P / '31, John Carroll Univ, '58,—

Burroughs Corp, Electro Data Div, 585 University St, Montreal Ave, Montreal, Que

Baudot, John A / Techl Repr, . . . / AMP / '29, McGill Univ, '56,—

Scully, George V / Compr Specialist, . . . / AS / '18, McGill Univ, '56, sell elecnc dig compg systems

Computing Center, Univ of Ky, Ky

Hamblen, John W / Dir, . . . / AMP, Instruction / '24, Indiana Univ (AB), Purdue Univ (MS, PhD), '56, compg ctr admn and consltnt

Lotz, Carol J / Mach Supv, . . . / ABP / '31, Univ of Louisville, Univ of Ky, '58, mach supv

Navarro, Silvio O / Asst Dir, . . . / ADELMP / '27, Univ of Houston (BS), Texas A & M (MS, PhD), '56, res and teaching / FAST Prgmg Sys, A form address to SOAP, translator for IBM 650

Tarpey, Paul R / Data Prcg Chief, . . . / ABP, Instruction / '33, Oklahoma St Univ (BS, MS), '59, data prcg chief

Hospital Service Association of Western Pa, Union Trust Bldg, Pittsburgh, Pa.

King, Dewey / Prgmr, . . . / ABP / '29, Univ of Pittsburgh, '57, systems analyst, prgmr

Moore, Joan / Prgmr, . . . / ABMP / '36, Univ of Pittsburgh, '58, systems analyst, prgmr

Schuler, Robert / Prgmr, . . . / ABP / '35, Univ of Pittsburgh (Grad. Schl, '59), '57, systems analyst, prgmr

Zack, William W / Mgr, Elecnc Data Prcg, . . . / ABP / '30, Univ of Pittsburgh (Grad Schl, '59), '57, systems analyst, prgmr

Imperial Oil Limited, 300 9th Ave W, Calgary, Alberta, Can

Hodson, Bernard A / Prgm Analyst, . . . / MP, Lecturing / '28, Manchester Univ, '55, mathn / Pubshed paper on Gas Turbine Dsn, won Royal Aeronautical Society Award

Kemp, E M / Prgm Analyst, . . . / BP / '34, Univ of Western Ontario, '59, engr

Logistics Systems Development Section, Systems Development Branch, Statistical Services Div, Comptrlr, Ogden Air Material Area, Hill Air Force Base, Utah

Painter, Dean C / Mgm Analyst (Dig Comptr Systems), . . . / ABCP, Systems Desn and analysis for Business Mgm and Logistics Systems / '25, Weber Junior Coll, '55, systems analyst

Plant, Thomas E / Mgm Analyst (Dig Comptr Systems), . . . / ABCP, Systems Desn and analysis for Business Mgm and Logistics Systems / '29, Univ of Utah, '56, systems analyst

Pomeroy, Charles E / Mgm Analyst (Dig Compr Systems), Proj Ofcr, . . . / ABP, Sys Desn and analysis for Business Mgm Aplns & Logistics Systems / '23, Univ of Utah, '55, systems analyst

Minneapolis-Honeywell, Datamatic Div, 1825 Conn Ave N W, Washington, D. C.

Crawford, Lyle C / Aplns Analyst, . . . / AB / '32, Univ of Arkansas, '57,—

Findling, Irwin H / Methods Analyst, . . . / AB, Retail Aplns / '33, New York Univ, '56, systems analyst

Kirkland, Byron E / Methods Analyst, . . . /ABPS, Graphic aids to educ in the compr field / '32, Strayer College of Accountancy, '54,—

Lovvorn, Homer B, Jr, / Methods Analyst, . . . / ABP / '32, Georgia Tech, '58, methods analyst

Mullinax, Roy Paul / Methods Analyst, . . . / AMP / '28, Furman Univ, '53, systems analyst

Thompson, Sam H / Methods Analyst, . . . / AS / '35, Univ of Tennessee, '57, methods analyst

The National Cash Register Co, 50 Rockefeller Plaza, New York 20, N. Y.

Fokens, Henry / Mgr, Elecnc Mach Sales, . . . / ASP / '14, State Teachers Coll of N J, '55, elecnc mach sales, NCR 304

Hundt, Frank J / Sales Repr, Elecnc Mach Sales, . . . / APS / '17, Pace Inst, '58, elecnc machine sales, NCR 304

Misdom, Walter E / Aplns Repr, Elecnc Mach Sales, . . . / APS / '34, Stevens Inst of Technology, '55, elecnc mach sales, NCR 304

Rude, John F / Aplns Repr, Elecnc Mach Sales, . . . / APS / '30, Seton Hall Univ, '55, elecnc mach sales, NCR 304

Saeger, William T / Aplns Repr, Elecnc Mach Sales, . . . / APS / '31, Stevens Inst of Technology, '57, elecnc mach sales, NCR 304

R. A. D. C., Rome, N. Y.

Motto, Richard / Mathn, . . . / PM / '35, Utica Coll, '56, mathn

Squire, Clark / Mathn, . . . / PM / '37, Prairie View A & M College of Texas, '56, mathn

System Development Corp, 2500 Colorado Ave, Santa Monica, Calif.

Brown, Kenneth W / Prgmr, . . . / LMP / '35, N. C. State Coll, '59, prgmr

Cottman, Norman C, Jr / Compr Prgmr, . . . / ABLMP / '28, UCLA, '58, prgmr

Fearing, Edward A / Prgmr, . . . / ABLP / '32, Univ of Calif, '58, prgmr

Fletcher, James M / Prgmr, . . . / LP / '28, Compton, Coll, UCLA, '56, prgmr

Jackson, Wm R / Prgmr, . . . / P / '25, Univ of Mo, '50, prgmr

McVeigh, Douglas H / Prgmr, . . . / LP / '31, San Francisco State Coll, '59, prgmg

Melink, Nicholas / Prgmr, . . . / ABP / '35, Univ of Calif, '59, prgmr, analyst

Pontelle, Gloria J / Prgmr, . . . / LP / '39, Purdue Univ, '59, prgmg

Toche, Catherine E (Mrs) / Prgmr, . . . / LMP / '33, UCLA, '59, prgmr

Texaco Canada Limited, 1425 Mountain St, Montreal Que

Kerr, Douglas, Jr / Proc Engr, . . . / ALMP / '33, McGill Univ, '58, prgmg conslnt & analyst

Loucks, Robert B / Proc Engr, . . . / ALMP / '33, McGill Univ, '58, prgmg conslnt & analyst

---

Abrams, Walter G / Systems Analyst Prgmr, U. S. Army QM Corps, USAQMSC, Box 31, APO 169, New York, N Y / ABP/ '32, Georgia Inst of Technology,—, military ofcer, U. S. Army

Addis, Roland T / Res Analyst, Howard Savings Instn, 251 Plane St, Newark, N J / AP, Elecncs in banking / '31, Dartmouth, '57, res analyst

Aghib, Edward G / Mgr, Product Plng, Monroe-Litton Industries, 555 Mitchell St, Orange, N J / ABDEPS / '22, Univ of Lausanne (IE, '45), Switz, '47, dept mgr, engr / author several reports on automatic eqpm for toll rds and toll systems

Anderson, Robert F / Branch Mgr, Minneapolis-Honeywell, 1825 Conn Ave, Washington, D C / AS / '27, MIT, '52, sales mgr

Beaton, Hugh R / staff engr, Constr Div, Engrg Dept, E I du Pont de Nemours & Co, Wilmington, Del / ABP, systems desn / '26, Harvard, '54,—

Belan, Edward F / Supr, Communicns and Maintenance, Telecomputing Corp, Engrg Services Div, P O Box 1684, Vandenberg AFB, Calif / ACDEL, remote operatn and input / '22,—, '53, select/desn EDP systems and supplemntry devices

Belser, George R / Prgmr, Commodity Credit Corp, 4706 Motley, Mesquite,

Tex / P, quality contr of compr output / '28, Univ of Tex, '58, acctnt

Bertsch, Louis J Jr / Compg Group Leader, So Calif Cooperative Wind Tunnel, 950 S Raymond, Pasadena, Calif / ABMP / '32, Los Angeles State College, '54, compg analyst

Chesis, Sheldon / Methods Analyst, Minneapolis-Honeywell Regulator Co, Datamatic Div, 1825 Conn Ave, Washington, D C / ABMP / '34, George Washington Univ, '57, methods analyst

Cooley, Emerson F / dir Methods Research, Prudential Ins Co of America, Newark, N J / ABP, Educational Methods / '09, Dartmouth, '47,—

DiCostanzo, John A / Staff Engr, IBM Corp, Kingston, N Y / ADPR, system testing / '28, Holy Cross College, '55, prgmg project coordinator

Drove, Charles C V / Senior Systems Analyst and Compr Prgmr, Compania Shell de Venezuela, Apartado 19, Maracaibo, Venezuela / ABP / '20, University Europe, '56, economist

Duke, Mrs Jane Thomas / Dig Compr Prgmr, Commodity Credit Corp, 500 S Ervay St, Dallas, Tex / ALP / '20, East Texas State Teachers College, '58, dig compr prgmr

Ehrenberg, Dennis F / Compr Prgmr, Atlantic Flt Opconcenter, Cinclant, Norfolk 11, Va / ABP / '34, Univac Scientific 1103A Systems Operations Training, '59, prgmg, USN

Fegan, Albert A / Pres, State Sound Service, 17 W Magnolia St, Calif / ACEM, latest improvements elecnc controls / '99, (have not stopped going to school), '59, installation and maint genl opern / Member IRE, AES, SMPTE, Nuclear Dir AIME, Who's Who in Calif, Who's Who in the West

Feitler, Joseph / Assoc Engr, IBM—Federal Systems Div, CPO Box 120, Kingston, N Y / ADEMP, Analog compr aplns / '25, CCNY, Columbia Univ, '47, engr analytical techniques group, systems dept / Talk at Eastern Simulation Council (10/59) on "An Automated Data Comparison Procedure for an Analog Computer"

Fleming, Jim / Dig Compr Prgmr, Commodity Credit Corp, 12007 Gaiter Dr, Mesquite, Tex / ALP / '30, N Tex State, '59,—

Fonesca, John R / Dept Head, Banking, Ins, and RE, Mohawk Valley Techl Inst, Utica, N Y / P Education / '25, Harvard Law,—, coll adm

Freefield, Rowena W / Dig Compr Prgmr, Commodity Credit Corp, 500 S Ervay, Dallas, Tex / BD, Transptatn and Traffic Mgm Aplns and Systems Desn / '17, Southern Methodist Univ, '57 frt traffic ofcr

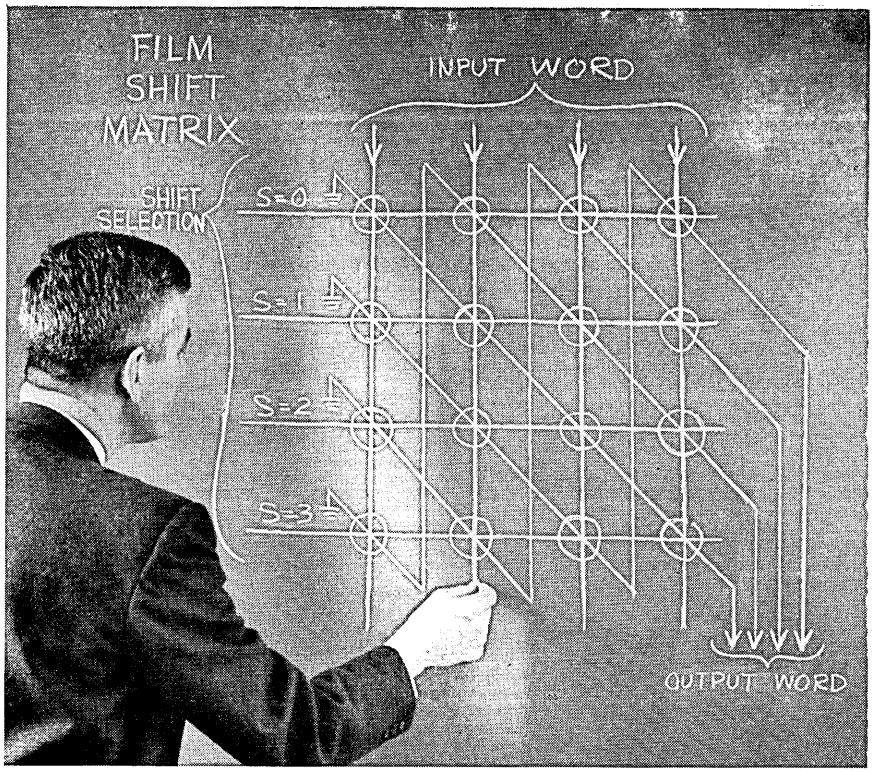
Fretz, William L Jr / Supr, Analysis and Prgming, Data Procg Section, Westinghouse Atomic Power Lab, PO Box 1526, Pittsburgh 30, Pa / ABP / '29,—'47, oper

Gillis, James W / Engr, Bendix Radio, APO 925, San Francisco, Calif / ELP / —, —, —, —

Giorgi, Oliver J / Systems Reliability Engr, RCA, Camden, N J / Reliability / '32, PWT Inst, '56, sr desnr / Published summarys on Reliability, Devised New Methods of Component Analyzing, Desnd proper documentation to accept reliability inform

Goertz, James J / Compr Prmgr, Convair-Div of General Dynamics Corp, 3201 Pacific Highway, San Diego, Calif / MP / '34, San Diego State Coll, '59,—

Halbrecht, Herbert / Pres, Herbert Halbrecht Assoc, Inc, 332 S Mich Ave, Chicago 4, Ill / AB, Personnel Re-



This logic array has been developed in the Remington Rand Univac Mathematics and Logic Research Department. In simplified form, each circle represents a film element that AND's the bits from the horizontal and vertical lines to produce an output on the diagonal line. The input word is therefore left-circular shifted S places in passing to the output. Such matrixes can produce arbitrary right or left shifts, either circular or open-ended, in a single clock period for full length computer words. Film logic arrays open a new field of high speed, high density logic devices.

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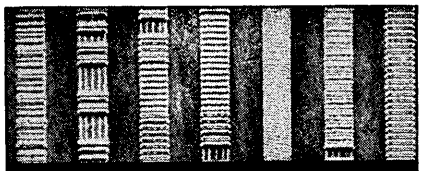

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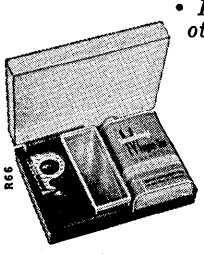

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Hans, M William / Aplns Engr, Princeton Computation Center, PO Box 582, Princeton, N J / AMP / '28, Queens College, '57, aplns engr

Healy, Edward B Jr / Systems Analyst, Atlantic Terminal Transit Command, 1 First Ave, Brooklyn, N Y / ABP / '33, Columbia Univ, '57, logistics

Henry, Michael J / Business Systems Analyst, GE Co, PO Box 988, Huntsville, Ala / ABP, engrg documentation / '32, Spring Hill College, '54, systems analyst / Published a paper, GE Techl Informn Series entitled, "Parts Generation"

Hessler, Wm G / Development Engr, EDPM Progrms, Western Electric Co, Hawthorne Sta, Chicago 23, Ill / ABP / '26, Purdue Univ BS, Northwestern Univ M Bus Ad, '58, engr / Publication, Self Initializing Counter, Hawthorne Computerama, Issue No. 33, May 12, '59 / Alpha Kappa Pse, Eta Kappa Nu, Delta Sigma Phi

Holley, Wm Carl Jr / Methods Analyst, Minneapolis-Honeywell Regulator Co, Datamatic Div, 1825 Conn Ave, NW, Washington, D C / ALP / '29, American Univ, '56, prgmr

Holmes, E A III / V P, Industrial Products, Autonetics, a div of North American Aviation, Inc, 9150 E Imperial Hwy, Downey, Calif / ABCDELMPS / '21, MIT, '57, mgr mkt plng

Horton, Dr Thomas R / Mgr, 700-7000 Systems Mkting, IBM Corp, 112 E Post Rd, White Plains, N Y / APS / '26, Univ of Fla, '54,—

Howell, John R / Prgmr, Stat Section, Ag Exp Sta, Univ of Fla, Gainesville, Fla / BMS / '30, Univ of Fla, —, prgm statistical probs

Imislund, Charlotte A / Dig Compr Prgmr, Commodity Credit Corp, 2505 Klondike Dr, Dallas 28, Tex / ALP / '29, Kahler School of Nursing, '58, prgmr

Irby, Jack G / Chief Prgmg Staff, U. S. Dept of Agr, 500 S Ervay St, Dallas 1, Tex / BP / '21, LaSalle, '57, suprvsn of prgmg staff using 705-III compr

James, D L / Systems Engr, Itek Corp, 1605 Trapelo Rd, Waltham 54, Mass / ABLMP / '28, MIT, '53, engr mgr

Jones, Walter T Jr / Compr Dept Mgr, Queen Knitting Mills Inc, 2701 N Broad St, Phila, Pa / BP / '26, Drexel Inst of Tech, '58, acctnt

Kalbach, John F / Assoc Dir, Engrg, Burroughs Corp, Pasadena, Calif / D, Reliability / '14, Univ of Washington, '51, engr

Kinnison, Frank D Jr / Techl Asst, Numerical Analysis Group and Mathn, Aerojet General Corp, Box 1947, Sacramento, Calif / '29, Calif State Polytechnic Col, '59, mathn, prgmr, techl advisor

Kirby, Clifford / Supr of Tele-Comm, Delta Airlines, Atlanta Airport, Atlanta, Ga / AB, Gen purp for airline oprns and res use / '14,—, '55, communicatns

Kobe, S P / Mgr Radio and Teletype Systems, Capital Airlines Inc, Washington National Airport, Washington, D C / ADP / '16, Keystone Radio Inst, '58, —

Koerner, Horst G / Physicist, AVCO Electronics Research Labs, 750 Commonwealth Ave, Boston 15, Mass / ADELP, Informn retrieval / '32, Northwestern Univ, '59, physicist

Korsun, M / Dir of Data Procg, Shahmoon Industries, Inc, 55 Liberty St, New York 5, N Y / ABLMP / '10, —, '56, —

LaHood, Joseph Jr / Staff Engr, Systems Developmt, Bendix Systems Div, 3300 Plymouth Rd, Ann Arbor, Mich / ALMP / '30, Univ of Mich, —, systems engr

Langhorne, Thomas Churchill / Systems Reviewer, Prudential Ins Co, Newark, N J / ABP / '31, Citadel, Rutgers, '57, —

LaRoche, Francis Edward / Techl Writer, Stanford Univ Graduate School of Business Research Center, 560 Alvarado Row, Stanford, Calif / techl writing and editing in the compr apln field / '28, Univ of Mich, '54, techl writer

Larrabee, Robert W / Aplns and Prgmg Analyst, Monroe Calculating Machine Co, Electronics Div, 555 Mitchell St, Orange, N J / ABP / '30, Texas Techl College, '53, —

Lucke, Lt Col CE W N / Dir, Engr Data Procg Center, Office of the Chief of Engrs, Washington 25, D C / ABCD-ELMP / '15, Harvard, '56, Lt Col, U S Army

Martasin, Lt Col W N / Officer in Charge, Systems Engrg Section, Statistical and Acctg Branch, TAGO, Pentagon, Washington 25, D C / ABP / '16, Ohio State Univ, MBA, '59, Lt Col, U S Army

McCall, J C / Mathn—Mbr of Techl and Scientific Staff, Computation Lab, Army Ballistic Missile Agency, Redstone Arsenal, Huntsville, Ala / AMP / '27, Univ of Ill, '55, civ serv, appln of IBM 7090 to engring problems, library subroutine investigations, etc

McInnis, D P / Cust Engr, IBM Corp, 1111 Conn Ave, Washington, D C / ADELMP / '29, N C State College, '57, cust engr

Miller, William F / Dir, Applied Mathematics Div, Argonne Natl Lab, Box 299, Lemont, Ill / DLM / '25, Purdue Univ, Ph.D, '55, physicist, mathn

Morton, Walter B Jr / Project Mgr, Epsco-West, a Div of Epsco Incorp, 240 E Palais Rd, Anaheim, Calif / EM, economics / '26, Carnegie Tech, Lehigh Univ, '51, elec engr

Moss, Judith / Chief, Integrated Data Prcg Div, City of Philadelphia, 802 City Hall Annex, Philadelphia 7, Pa / AB / —, Vassar College, BA, Columbia Univ, MA, '55, —

Naruoka, Masao / Dr of Engrg, Dept of Civil Engrg, College of Engrg, Univ of Ill, Urbana, Ill (to Sept '60), Dept of Civil Engrg, Yoshida Honmachi Sakyo-ku, Kyoto, Japan (after Sept '60) / '18, Dept of Civil Engrg, Kyoto Imperial Univ, '57, Prof of Structural Analysis, Kyoto Univ (Japan), Postdoctral Fellow in Civil Engrg (to Sept, '60) / Publication, On Application of Digital Compr to Structural Analysis, Proc of Japan Soc of Civil Engrs, Vol 43, No 12 and Vol 44, No 1, '58 and '59; Digital Compr Analysis of Orthotropic Parallelogram Plate, Mem of Fac of Engrg, Kyoto Univ, Vol 21, No 2, '59

Nasmeh, Salim J / Systems and Electronic Data Procg Analyst, Ford Motor Co, M E L Div, 3000 Schaefer Rd, Dearborn, Mich / ABP, Installation, Feasibility Studies / '22, Univ of Missouri, BJ '51, MA '54, '55, systems and electronic data prcg analysis

Nichols, Joe E / Research Mathn, Shell Oil Co, Houston Research Lab, PO Box 2527, Houston, Tex / ABDELMP / '30, Univ of Houston, '56, O R specialist / Paper entitled "An Improved Multiple Regression Analysis Program for the IBM 650" presented at ORSA 150th Nat'l Meeting, May 15, '59

Pelletier, Hermel / Asst Supr, Provincial Government, Dept of Agrcltr, Quebec / AMP / '34, St Jean Baptiste, —, —

Perstein, Millard H / Compr Systems Spec, System Development Corp, 2500 Colorado Ave, Santa Monica, Calif / MP, Data Procg Research / '25, Univ of Calif, '55, — / Secretary SHARE

Peterson, Norman D / Chief of the Machine Statistics Unit, Army Personnel Research Branch, Washington 25, D C /ALMP, apln to stat psych & operths res / '28, State Coll of Wash (MS), '55, mathn / artl "702 Prgng Aid & Pitfalls," Compg News, July, '56; Phi Beta Kappa, Psi Chi

Petrover, Lothar Leopold / Analyst, Broadview Research Corp, 1811 Trousdale Dr, Burlingame, Calif / ABLP, Economics, Militry Adm / '31, City Coll, N Y (BA), '56, analysis, desn, & prgmg specs / Mbr Soc of American Military Engrs, Reserve Ofc's Assoc, American Mgm Assoc

Pomeroy, Richard W / Sr Consltnt, Arthur Young & Co, 165 Broadway, New York 6, N Y / ABP / '22, Columbia Univ, —, Mgm Consltnt / Contributed chapter on "Systems Charting" for SYSTEMS AND PROCEDURES, A HANDBOOK FOR BUSINESS AND INDUSTRY (Prentice-Hall '59)

Rees, John H / Snr Engr, Lago Oil & Transport Co., Ltd, P.O. Box 311, Lago Colony, Aruba, Netherlands Antilles / Aplns to techn, industrial, engrg problems, mathl techniques, and operations analysis / '24, M I T, '53, chemical engr

Russo, Roy L / Instr in Elec Engring, Pa State Univ, University Pk, Pa / ADL, educ of logical desn engrs / '35, Pa State Univ, '57, Instr in elec engring and logical Desn Engr

Schneider, Franz W / Research Asst, Math Dept, Univ of Chicago, Chicago 37, Ill; RCA Labs, Princeton, N J (after June, '60) / ALMP / '32, Univ of Chicago, '53, mathn

Schneidewind, Norman / Data Prcg Analyst, Title Ins and Trust Co, 433 S Spring St, Los Angeles, Calif / AP / '28, Univ of Calif, '56, elec engr

Schnittger, Harry F / Dir, Data Procg and Systems, Beech Aircraft Corp, 9709 E Central Ave, Wichita, Kan / ABP / '23, St. Louis Univ, '57, data procg and systems

Schwartz, Jack M / Dept Head, Chrysler Corp, Missile Div, P. O. Box 2628, Detroit 31, Mich / AD, EDP Systems / '21, Univ of Detroit, '60, engr

Shelton, Russell O / Dir, Current Aplns, Compg Dept, Phillips Petroleum Co, Bartlesville, Okla / AMP / '24, Northwestern Univ, Okla State Univ, '51, chem engr

Simmons, F P /Staff Scientist, Link Div, GPI, Binghamton, N Y / AD / '26, MIT and George Washington Univ, '50, engr / Patent, Polar Analog Navigation Cmptr; Publication, Solid State Analog Comptr for Automatic Gas Flow Compns, IRE Int'l Convention, 3/60

Sparks, B W / Mgr, Data Prcg Planning, RCA Missile Test Proj, Patrick AFB, Fla / ABLM / '20, Purdue Univ (PhD '52), '52, planning engr

Stagg, Glenn W / Head, Compr Aplns Section, American Electric Power Service Corp, 30 Church St, New York 8, N Y / ABP, simulation studies of elecnc systems / '23, MIT (BSEE '49), NYU (MSBA, '55), '52, compr apln engr / Mbr AIEE, Eta Kappa Nu award for outstanding elec engr, '57, papers and artls on compr aplns

Stewart, William A, Jr / Sector Prgmg Leader, Detroit Air Defense Sector, System Develop Corp, 2500 Colorado Ave, Santa Monica, Calif / P / '24, Ohio State Univ, '56, occupation teacher

Stoian, Eliodor / Data Procg Engr, Oil and Gas Conservation Board, 603 6th Ave S W, Calgary, Alberta, Can / A, P in Petroleum Engrg / '21, Mech Engrg, Special Petroleum Section, '58, petroleum engr

Tolpin, Gerald / Procdrs Analyst, Raytheon, Maynard, Mass / AB / '29, Boston Univ, '55, pgrmr / Mbr, ORSA

Warlick, Charles H / Mgr, Mathl Aplns Developmt, G E Co, Compns Operation, Flight Propulsion Lab, G E Co, Bldg 305, Cincinnati 15, Ohio / AMP / '30, Univ of Maryland, '52, mgr of a group engaged in res in numerical and applied mathl analysis / Co-author with D M Young: *On the Use of Richardson's Method for the Numerical Solution of Laplace's Equation,* BRL Mem Report 707, '52

Warren, Leland C / Methods Analyst, Baltimore & Ohio Railroad, Methods Research & Procdrs Dept, B & O RR, Central Bldg, Baltimore & Charles Sts, Baltimore, Md / ABP / '26, Wharton Schl of the Univ of Pa, '58, Systems and Procdrs Analyst and Prgmr for DATAmatic 1000 / Mbr, Systems & Procdr Assoc of America, American Statistical Assoc.

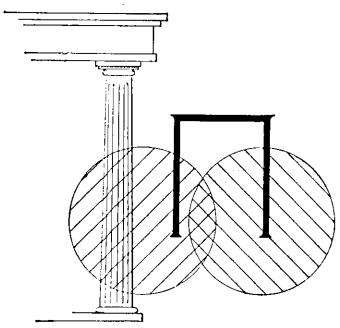
White, Patrick J / Chief, Data Prcg Branch, Compt's Office, Army Ordnance Corps, Frankford Arsenal, Tacony & Bridge Sts, Phila 37, Pa / ABLMP / '30,—,'53, dig compr sys adm / developed first payroll and leave acctg comptr apln for Army Ordnance Corps

Wright, John H / Mgr of Customer Serv and Educ, Daystrom, Inc, Control Systems Div, 4455 Miramar Rd, La Jolla, Calif / A, Customer Trning, Customer Educ / '25, MIT, '59, serv mgr.

Wrigley, Charles F / Prof of Psychology, Dept of Psych, Mich State Univ, East Lansing, Mich / '17, Univ of London (PhD), '51, Univ Prof / "Use of an Elecnc Compr in Principal Axes Factor Analysis" J Educ Physchol '55

Young, William E L / Chief, Data Procg Ctr, Ohio Dept of Finance, Columbus, Ohio / BP / '16, Capital Univ, Ohio State Univ, Case Inst, Industrl College of Armed Forces, '42, punched card / Participating author of "Punched Card Annual," (Gille Assoc), author of magazine articles and lecturer on ADP

Zagor, Herbert I / Engrg Scientist Consultant, RCA, 75 Varick St, New York, N Y / ALM / '16, New York Univ, '46, physicist /Publications in reliability, sys analyst, nuclr physics, operations res, Consltnt at Convair, San Diego, Calif & G E Co, Santa Barbara, Calif



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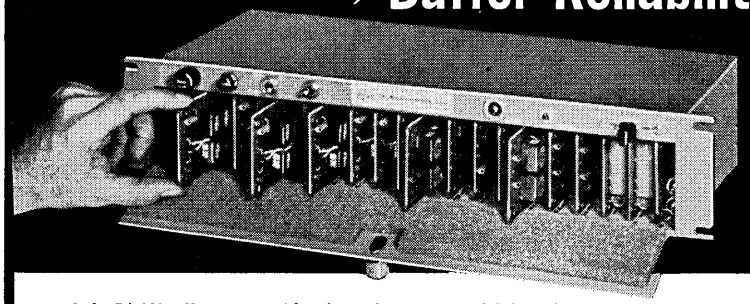

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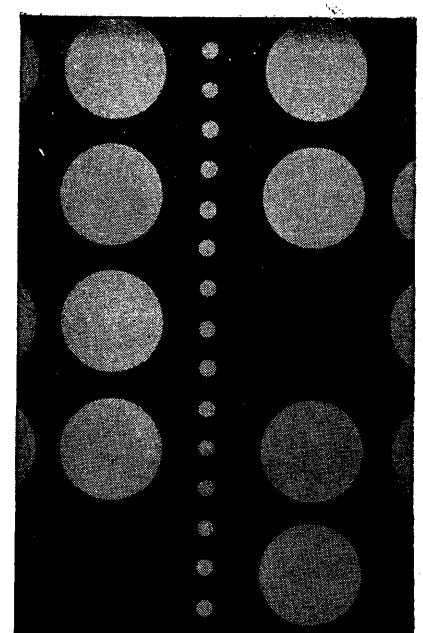

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Ackoff, Russell L., editor / Progress in Operations Research, Vol. I / John Wiley & Sons, Inc., 440 Park Ave. South, New York 16, N. Y. / 1961, printed, 505 pp, $11.50.

This book contains a great deal of information on technical progress in the field of Operations Research, with emphasis on applications, unsolved problems and the "state of the art." The first of eleven chapters, by the editor, discusses "The Meaning, Scope, and Methods of Operations Research." Subsequent chapters include: "Dynamic Programming," "Sequencing Theory," "The Theory and Application of Simulation in Operations Research" and "Military Gaming." Philip M. Morse, of M. I. T.'s Computation Center, discusses "Dynamics of Operational Systems: Markov and Queuing Processes." Author and subject indices.

Rees, Paul K., and Fred W. Sparks / College Algebra, Fourth Edition / McGraw-Hill Book Co., Inc., 330 West 42 St., New York 36, N. Y. / 1961, printed, 428 pp, $6.50.

This edition includes the information presented in the third edition with revisions of certain material to satisfy the latest technological needs. In addition, new articles have been added on broken-line functions, solutions of problems by means of simultaneous equations, effective rate and determination of the periodic payment, term and rate. The book includes twenty-two chapters, beginning with "The Four Fundamental Operations" and proceeding to "Exponents and Graphs," "Ratio, Proportion, and Variation," "Higher-Degree Equations," "Determinants," etc. An appendix includes answers to problems given throughout the text, a glossary and mathematical tables. Index.

Langer, Rudolph E., editor, and 19 authors / Partial Differential Equations and Continuum Mechanics / University of Wisconsin Press, 430 Sterling Court, Madison 6, Wisc. / 1961, photo offset, 397 pp, $5.00.

The nineteen lectures which were delivered at the International Conference of the Mathematics Research Center, University of Wisconsin, June, 1960, are here published. Among the titles and contributors: Aspects of Differential Equations in Mathematical Physics, Claus Müller; The Angular Distribution of Eigenvalies of Non Self-adjoint Elliptic Boundary Value Problems of Higher Order, Shmuel Agmon; Finite Deformation of Plates into Shells, B. R. Seth; Atypical Partial Differential Equations, Hans Lewy; etc. In addition, forty-two abstracts of contributed papers are included. Index.

Leeds, Herbert D., and Gerald M. Weinberg / Computer Programming Fundamentals / McGraw-Hill Book Co., Inc., 330 West 42 St., New York 36, N. Y. / 1961, printed, 368 pp, $8.50.

For those with little technical background this book is an excellent introduction to computer programming in general, and IBM 7090 programming in particular. Following a first chapter on "What is a Computer?", the authors discuss the entire programming process from flow diagramming to machine production runs. Among the eleven chapters are: Indexing, Subroutines, Introduction to Input-Output, and Arithmetic. Lists of 7090 instructions and SOS (Share Operating System) pseudo-operations, and an index, are included.

Beckenbach, Edwin F., editor, and 16 authors / Modern Mathematics for the Engineer, Second Series / McGraw-Hill Book Co., Inc., 330 West 42 St., New York 36, N. Y. / 1961, printed, 456 pp, $9.50.

The applications of advanced mathematics to current technological needs are discussed in sixteen papers, given as a series of lectures—1958-59 at the University of California. The applications include mathematical techniques used in biology, economics, sociology and physics. The first part of the book, Mathematical Methods, consists of five papers including: "From Delta Functions to Distributions," "Integral Transforms," and "Asymptotic Formulas and Series." Part two, Statistical and Scheduling Studies, includes: "Chance Processes and Fluctuations," "Information Theory," "Formulating and Solving Linear Programs," and "The Mathematical Theory of Inventory Processes." Part three, Physical Phenomena, includes: "Applications of the Theory of Partial Differential Equations to Problems of Fluid Mechanics." Name and subject indices.

Korn, Granino A., and Theresa M. Korn / Mathematical Handbook for Scientists and Engineers / McGraw-Hill Book Co., Inc., 330 West 42 St., New York 36, N. Y. / 1961, printed, 943 pp, $20.00.

This handbook, encyclopedic in scope, presents reviews of important theory, formulas and definitions in a manner which allows for quick study and use. In twenty-one chapters, the authors include: Real and Complex Numbers, Plane and Solid Analytic Geometry, Functions and Limits, Vector Analysis, Complex Variable Theory, Ordinary and Partial Differential Equations, Matrices, Differential Geometry, Probability Theory, Statistics, Numerical Analysis, and Special Functions, e.g., Bernoulli polynomials and numbers. Six appendices include information about trigonometry, permutations and combinations, tables of Fourier expansions of indefinite and definite integrals, and the standard mathematical tables, e.g., logarithms, trigonometric functions, Bessel functions. Glossary of symbols and index.

NEW PATENTS

RAYMOND R. SKOLNICK
Reg. Patent Agent
Ford Inst. Co., Div. of Sperry Rand Corp., Long Island City 1, New York

The following is a compilation of patents pertaining to computer and associated equipment from the "Official Gazette of the U. S. Patent Office," dates of issue as indicated. Each entry consists of patent number / inventor(s) / assignee / invention. Printed copies of patents may be obtained from the U. S. Commissioner of Patents, Washington 25, D. C., at a cost of 25 cents each.

January 24, 1961 (Cont'd)

2,969,526 / Genung L. Clapper, Vestal, N. Y. / I.B.M. Corp., New York, N. Y. / A method and apparatus for handling and storing binary data.

2,969,528 / Tung Chang Chen, Havertown, Pa. / Burroughs Corp., Detroit, Mich. / A read-write circuit for magnetic recording.

January 31, 1961

2,969,730 / Lyle W. Brehm, Endicott, N. Y. / I.B.M. Corp., New York, N. Y. / A data translation and printing machine.

2,969,912 / Andrew C. Reynolds, Jr., Waterbury, Conn. / I.B.M. Corp., New York, N. Y. / An error detecting and correcting circuit.

2,969,913 / Alvin A. Cherin, Torrance, and Robert R. Johnson, Altadena, Calif. / Hughes Aircraft Co., Culver City, Calif. / Circuits for selectively shifting, extracting, and inserting digital information.

2,970,293 / John P. Eckert, Jr., Phila., Pa. / Sperry Rand Corp., a corp. of Del. / A binary counter.

2,970,294 / Sadia S. Guterman, Dorchester, Mass. / Raytheon Co., a corp. of Del. / A magnetic control circuit for shift registers.

2,970,296 / Paul V. Horton, Poughkeepsie, N. Y. / I.B.M. Corp., New York, N. Y. / A printed circuit ferrite core memory assembly.

2,970,297 / John A. Kauffmann, Hyde Park, N. Y. / I.B.M. Corp., New York, N. Y. / A magnetic branching circuit for handling binary information.

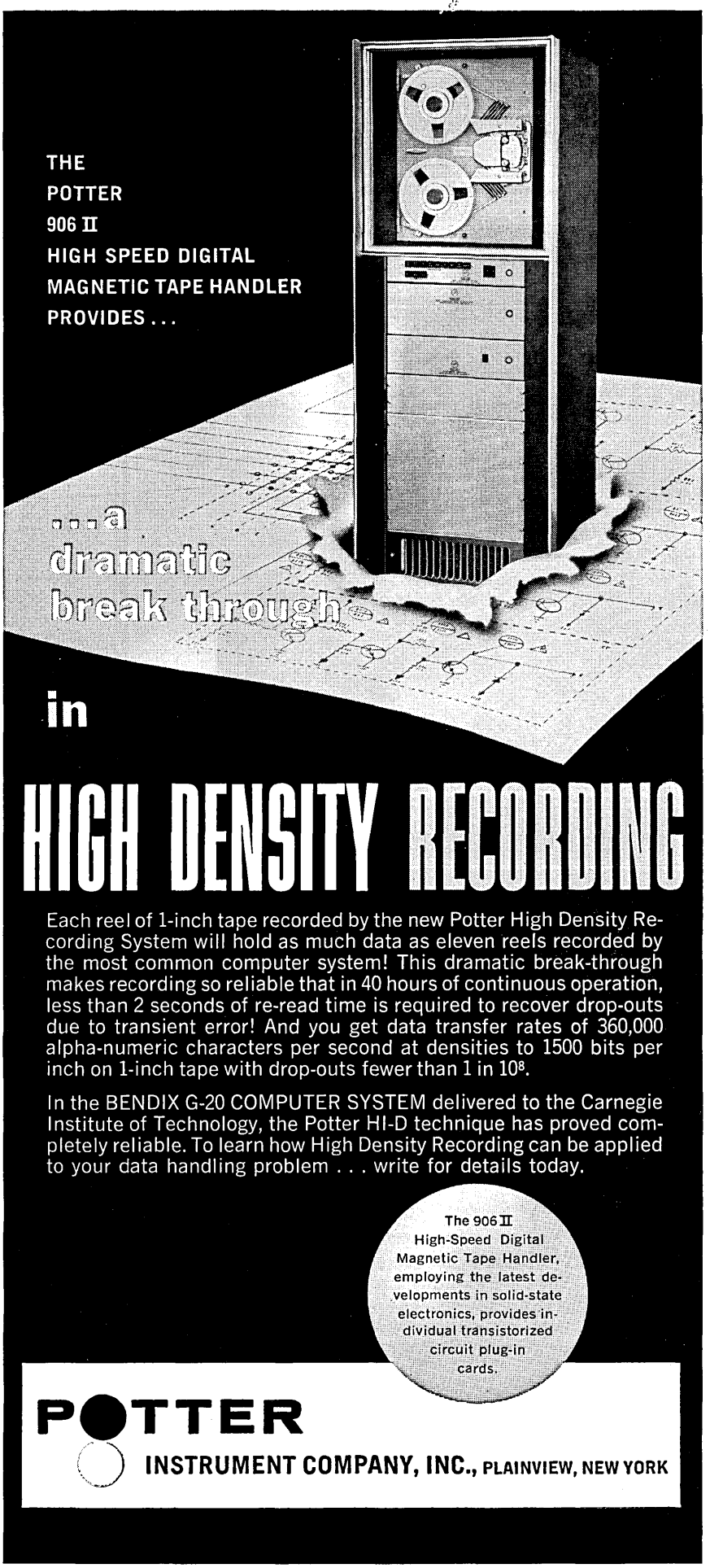
2,970,298 / Frank J. Prines, Penn Hills Township, Allegheny County, Pa. / Westinghouse Electric Corp., East Pittsburgh, Pa. / A bistable circuit.

2,970,299 / Herman Epstein, West Chester, and Oscar B. Stram, Paoli, Pa. / Burroughs Corp., Detroit, Mich. / Electrographic recording with magnetic material.

2,970,300 / Victor R. Witt, Poughkeepsie, Peter I. Prentky, Wappingers Falls, N. Y., and Erwin K. Dudek, Poughkeepsie, N. Y. / I.B.M. Corp., New York, N. Y. / A skew elimination system.

2,970,306 / Henry E. Zieman, Lexington, Mass., and Julius I. Woolf, Levittown, Pa. / Research Corp., New York, N. Y. / A digital to analogue decoder circuit.

2,970,308 / George A. Stringfellow and Erwin J. Emkjer, San Diego, Calif. / General Dynamics Corp., San Diego, Calif. / A parallel digital to A.C. Analog converter.



2,970,309 / William B. Towles, Timonium, Md. / U. S. A. as represented by the Sec. of the Navy / An analog to digital converter.

February 7, 1961

2,970,759 / Walter C. Lanning, Plainview, N. Y. / Sperry Rand Corp., a corp. of Del. / An absolute value reversible counter.

2,970,761 / Raymond Beranger, Paris, Fr. / North American Philips Co., Inc., New York, N. Y. / A digit indicator employing a shift register.

2,970,763 / Herbert Freeman, Great Neck, N. Y. / Sperry Rand Corp., a corp. of Del. / A predetermined pulse selector.

2,970,764 / William J. Deerhake, Dumont, Byron L. Havens, Closter, and Kenneth E. Schreiner, Harrington Park, N. J. / I.B.M. Corp., New York, N. Y. / A checking circuit for determining whether a multi-decimal position word expressed in binary-decimal notation and the indicator of said work are in accord.

2,970,765 / Raymond Bird, Letchworth, Eng. / International Computers and Tabulators Lim., a British Co. / A data translating apparatus.

2,970,766 / Herman Epstein, West Chester, Pa. / Burroughs Corp., Detroit, Mich. / A binary multiplier employing a delay medium.

2,971,056 / Alan J. Deerfield, Franklin, Mass. / Minneapolis-Honeywell Regulator Co., Minneapolis, Minn. / An information handling apparatus.

February 14, 1961

2,971,696 / Robert A. Henle, Hyde Park, N. Y. / I.B.M. Corp., New York, N. Y. / A binary adder circuit.

2,972,060 / Robert D. Torrey, Phila., Pa. / Sperry Rand Corp., a corp. of Del. / A logic circuit for producing complement output signals.

2,972,062 / Omer P. Clark, New Vernon, N. J. / Bell Telephone Lab., Inc., New York, N. Y. / A transistor binary counter.

2,972,063 / Arthur W. Carlson, Harrison, Maine / U. S. A. as represented by the Sec. of the Air Force / An impulse responsive circuit for binary counting.

2,972,082 / Hartmut P. Kallmann, Flushing, and Barnett Rosenberg, New York, N. Y. / Research Corp., New York, N. Y. / A data storage method and apparatus.

2,972,128 / John P. Eckert, Jr., Gladwyne, John C. Sims, Jr., Springhouse, and Herbert F. Welsh, Phila., Pa. / Sperry Rand Corp., New York, N. Y. / A phase modulated pulse recording system.

2,972,130 / Robert C. Minnick, Cambridge, Mass. / Bell Telephone Lab., Inc., New York, N. Y. / A magnetic core storage circuit.

2,972,131 / Gerhard Dirks, Frankfurt, Ger. / ..... / Apparatus for sorting signals recorded on a magnetisable signal carrier.

2,972,136 / Luther P. Giesler, Rockville, Md. / ..... / A data handling system and magnetic switching network therefor.

February 21, 1961

2,972,718 / Norman N. Alperin, Cinnaminson Township, Burlington County, and Warren A. Mulle, Morrestown, N. J. / U. S. A. as represented by the Sec. of the Navy / A synchronized sampled data digital servo.

2,972,733 / J. Fred Bucy, Jr., Dallas, Tex. / Texas Instruments Inc., Dallas, Tex. / A method and apparatus for analyzing data.

2,972,735 / Harrison W. Fuller, Boston, and Robert C. Kelner, Concord, Mass. / Lab. for Electronics, Inc., Boston, Mass. / A data processing system.

ADVERTISING INDEX

Following is the index of advertisements. Each item contains: Name and address of the advertiser / page number where the advertisement appears / name of agency if any.

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Automatic Electric, Northlake, Ill. / Page 2 / Kudner Agency, Inc.

Burroughs Corp., Detroit 32, Mich. / Page 7 / Campbell-Ewald Co.

DI/AN Controls, Inc., 944 Dorchester Ave., Boston 25, Mass. / Page 27 / Keyes, Martin & Co.

Electric Boat, a Div. of General Dynamics, Groton, Conn. / Page 17 / D'Arcy Advertising Co.

Honeywell Aero, Minneapolis-Honeywell Regulator Co., 2600 Ridgway Rd., Minneapolis 40, Minn. / Page 27 / Batten, Barton, Durstine & Osborn, Inc.

Hughes Aircraft Co., Culver City, Calif. / Page 28 / Foote, Cone & Belding

Litton Systems, Inc., Tactical Systems Laboratory, Canoga Park, Calif. / Page 30 / Compton Advertising, Inc.

The Mitre Corp., P.O. Box 208, 5-MU, Bedford, Mass. / Page 31 / Deutsch & Shea, Inc.

The National Cash Register Co., Dayton 9, Ohio / Pages 5, 23 / McCann-Erickson, Inc.

Philco Corp., Government & Industrial Group, Computer Div., 3900 Welsh Rd., Willow Grove, Pa. / Page 3 / Maxwell Associates, Inc.

Potter Instrument Co., Inc., Plainview, N. Y. / Page 29 / Gamut, Inc.

Reeves Soundcraft Corp., Great Pasture Rd., Danbury, Conn. / Page 26 / The Wexton Co., Inc.

Remington Rand Univac, Univac Park, St. Paul, Minn. / Page 25 / Mullen & Associates, Inc.

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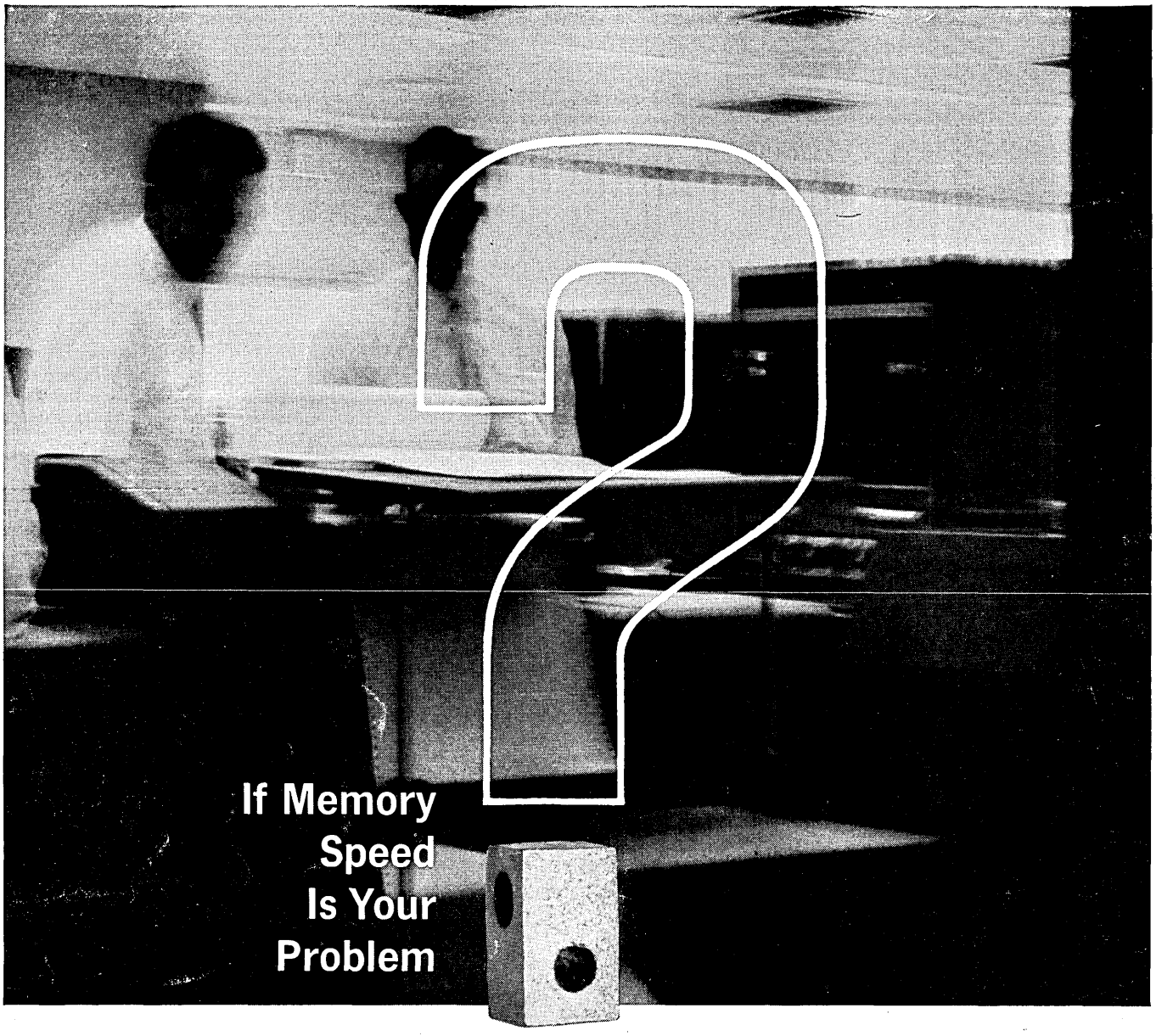

BIAX MEMORIES are the answer

Aeronutronic's BIAX INSTRUCTION MEMORIES will increase the speed of your computer, data handler, or control system. These remarkable memories operate at high speed, with non-destructive read, low power, and high reliability.

BIAX MEMORIES offer access time of 0.4 μsec and cycle time of 1.0 μsec without need for regeneration. These advanced memory systems will give you the necessary speed and reliability for all your program storage.

Specifications

Up to 1024 words
Up to 36 bits per word
Read cycle time: 1.0 μsecond
Access time: 0.4 μsecond
Loading: From paper tape or your equipment at rates up to 200 kc
Power: Less than 50 watts
Temperature: 0°C to 50°C

BIAX MEMORIES are available in several standard sizes or can be built to your specifications on a fixed price basis. Their low power requirements plus high reliability over a broad range of environmental conditions assure dependable performance.

For further information regarding BIAX MEMORIES' capabilities applicable to your requirements you are invited to write or call: Manager of Marketing, Computer Products Operations, Department 27.

AERONUTRONIC
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